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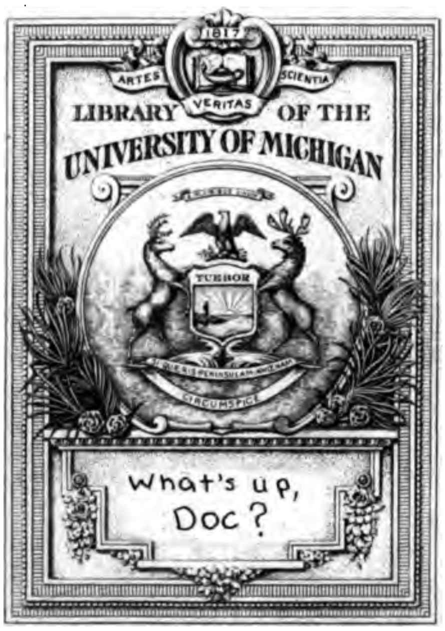
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BULLETIN

OF THE

UNITED STATES FISH COMMISSION.

VOL. XI.

FOR

1891.

MARSHALL McDONALD, Commissioner.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

Joint Resolution authorizing the Public Printer to print Reports of the United States Fish Commissioner upon new Discoveries in regard to Fish-culture.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Public Printer be, and he hereby is, instructed to print and stereotype, from time to time, any matter furnished him by the United States Commissioner of Fish and Fisheries, relative to new observations, discoveries, and applications connected with fish-culture and the fisheries, to be capable of being distributed in parts, and the whole to form an annual volume or bulletin not exceeding five hundred pages. The extra edition of said work shall consist of five thousand copies, of which two thousand five hundred shall be for the use of the House of Representatives, one thousand for the use of the Senate, and one thousand five hundred for the use of the Commissioner of Fish and Fisheries.

February 14, 1881.

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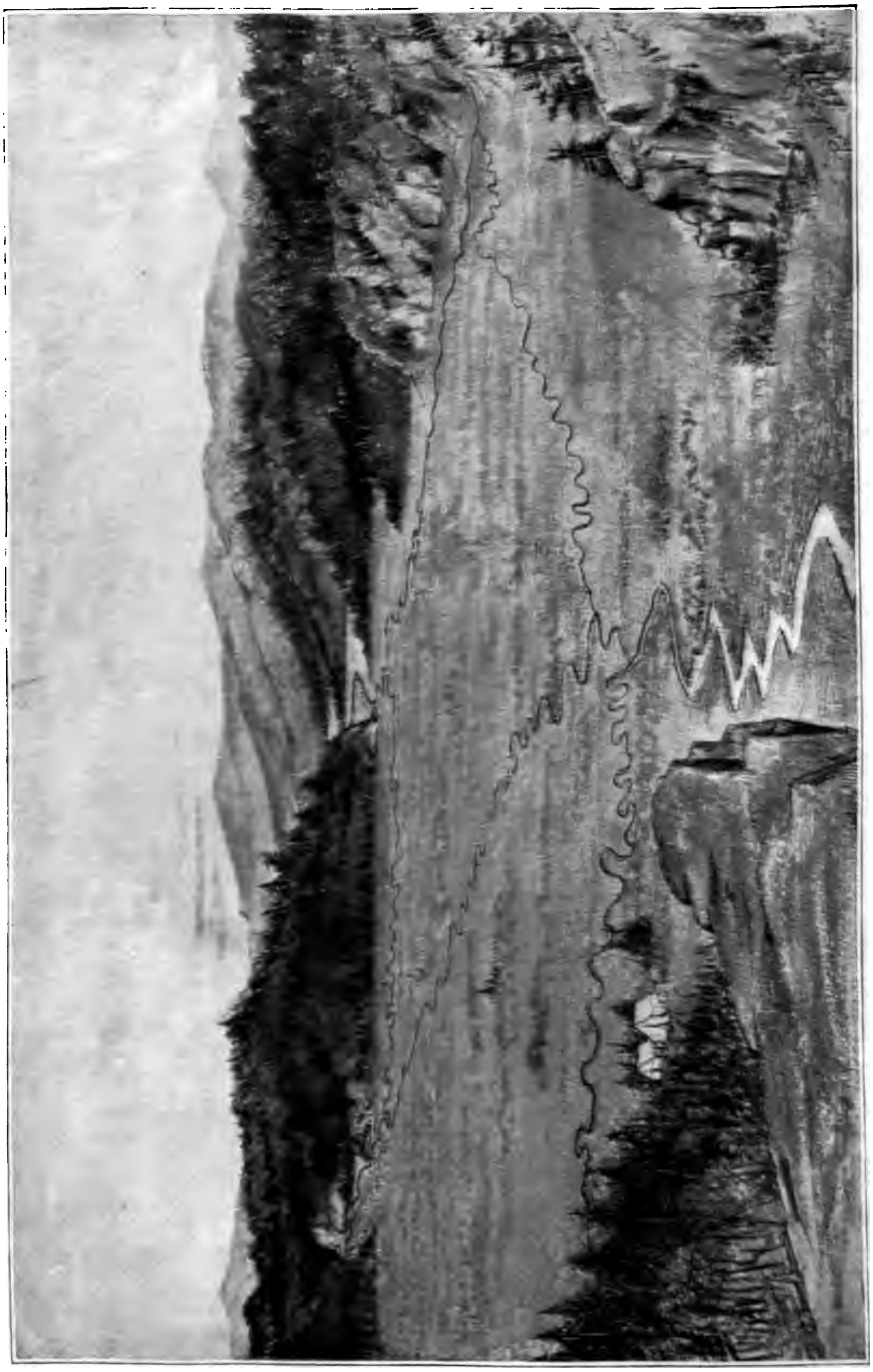

TWO-OCEAN PASS.

FISH-CULTURAL INVESTIGATIONS IN MONTANA, WYOMING, AND TEXAS.

INTRODUCTORY.

The investigations covered by the accompanying reports of Prof. Barton W. Evermann, assistant in the Division of Scientific Inquiry, entitled "A Reconnaissance of the Streams and Lakes of Western Montana and Northwestern Wyoming," and "Report upon Investigations made in Texas in 1891," were undertaken in compliance with instructions from Congress in an act approved March 3, 1891, as follows:

> *Fish-hatchery in the Rocky Mountain region and Gulf States:* For investigation respecting the advisability of establishing a fish-hatching station in the Rocky Mountain region in the States of Montana or Wyoming, and also a station in the Gulf States, one thousand dollars, each; in all, two thousand dollars.

These reports were transmitted to Congress in February, 1892, and were printed as Senate Miscellaneous Document No. 65, Fifty-second Congress, first session. The importance of the information conveyed in them has made it desirable that they should be put in a form that will permit of wider circulation, and they accordingly are presented as articles of the Bulletin.

The direct object of the investigations was for the purpose of determining the best locations for fish-cultural operations in the regions mentioned, but their scope was made more comprehensive for reasons which are obvious. The character of the fish-cultural operations which may be profitably undertaken in any region varies with climatic conditions and with the physical, chemical, and biotic features of its waters. These factors must be more or less accurately known in order to determine the extent and nature of the fish-cultural installation needed and to direct advantageously the stocking of the waters in the interest of which a station is sought to be established.

In Montana and Wyoming the field explorations were begun at Helena, Montana, July 18, 1891, and continued until August 27; in Texas they commenced November 2 and were prosecuted until December 7.

The field of investigation, both in the Rocky Mountain region and in Texas, was limited; it was not practicable, nor was it necessary for the particular purpose to be accomplished, to explore the entire area of the States named. From a knowledge of the conditions to be fulfilled I was able to limit the area to be examined and thus permit a more detailed and careful inquiry than would have been otherwise possible with the limited means available.

Important duties in connection with the operations of the Fish Commission steamer *Albatross* required Prof. Evermann's presence aboard the vessel before he was able to fully complete his studies of the fishes obtained in Texas. As soon as opportunity will permit, a supplementary report on the subject will be presented.

MARSHALL McDONALD,
Commissioner.

1.—A RECONNAISSANCE OF THE STREAMS AND LAKES OF WESTERN MONTANA AND NORTHWESTERN WYOMING.

BY BARTON W. EVERMANN, PH. D.,
Assistant, U. S. Fish Commission.

SUMMARY OF REPORT.

In this paper are presented the results of investigations in Montana and Wyoming made during the summer of 1891 under the direction of the U. S. Commissioner of Fish and Fisheries.

In carrying out the instructions furnished by the Commissioner, it was highly important that a careful study be made of the physical and natural-history features of the streams and lakes of the region. Attention was given to the general characters of the streams and lakes, their size, depth, current; the nature of obstructions, if any, in the streams; the source of water supply, whether from lakes, springs, or melting snow; the temperature of the water at different times and different places; its clearness, and to what extent contaminated by mining operations or heavy rains; the geology of the region through which the stream flows, and the composition and nature of the bottom and banks of each river or lake.

In studying the natural-history features of the streams special attention was given to the kinds of fishes they contain, their abundance, size, condition, and distribution; also to the invertebrate life, such as crustaceans, insects, and mollusks, serving as food for the fishes.

The important question of the geographical distribution of fishes was kept constantly in mind, and attempts were made to trace the limits in the range of certain species, and to determine, if possible, the definite solution of certain difficult problems presented in the distribution of the trout and blob in Yellowstone National Park.

In making my investigations looking toward the selection of a suitable site for a fish-cultural station, visits were made to as many places as our time would permit, or as was necessary for the purposes of the investigation. The station for this region would be devoted almost exclusively to the hatching and rearing of various species of trout and other *Salmonidæ*. The requirements for the successful operation of such a station may be stated briefly as follows:

1. *Pure water:* (*a*) A constant supply of not less than 1,000 gallons per minute. (*b*) The temperature should not at any time exceed 50° or 55°, and would better be under 50°. (*c*) There should be no danger of contamination from any source.

2. *Suitable ground:* (*a*) The amount should be 20 to 30 acres. (*b*) It should lie conveniently near to the source of water supply. (*c*) There should be sufficient fall

between the source of water supply and the hatchery building to permit a gravity supply. (*d*) The ground should lie so as to permit easy drainage of any or all of the ponds.

3. *The location* should be: (*a*) Central with reference to the region to be stocked. (*b*) Such as to afford good railroad facilities.

In the detailed portion of this report I have discussed at length the advantages offered by fourteen of the most promising localities. The one most nearly filling all the natural requirements is Horsethief Springs. These springs, located in Montana, near the northwest corner of the Yellowstone National Park, are among the largest and most remarkable that are to be found anywhere in the United States. Their remoteness from a railroad is apparently the only objection to them.

The springs at Botteler's ranch, just north of the Park, are excellent in every way, as are also the Davies Springs, near Bozeman. Child's bedrock drain near Helena, Cottonwood Creek at Deer Lodge, and Rattlesnake Creek near Missoula are places that should be considered, as each offers advantages of one kind or another.

After considering the advantages offered by each of these various places, I would recommend that the selection be made from the three which are near the Yellowstone National Park, viz. Horsethief Springs, Botteler Springs, and Davies Springs.

BRIEF STATEMENT OF ITINERARY.

I left Washington July 7, 1891, for the West, and, being joined at Terre Haute, Indiana, by Prof. O. P. Jenkins, of Leland Stanford Junior University, and Mr. Burnside Clapham, of Monroeville, Indiana, we proceeded to Leadville, Colorado, where we remained until July 15, when we left for Helena, Montana, where we arrived on the morning of the 18th. Here we began our work by examining the streams of that vicinity. From there we proceeded westward to Elliston, then south to Deer Lodge, Dillon, and Red Rock, carefully examining the waters of that region. Returning, we spent a little time at Silver Bow, then proceeded northwest to Missoula, where we spent three days exploring the streams accessible from that place. From Missoula we went still farther northwest to Ravalli, then by stage across the Flathead Indian Reservation to Flathead Lake, where we took the boat for Demersville, on Flathead River, about 30 miles above the head of the lake. After spending a day at Demersville, we took the steam yacht *Lillian*, which had been placed at our disposal by the owners, Hon. William Muth and Mr. Edward Harwood, and went down the river to the east side of the lake at the mouth of Swan River, where we stopped at the quarters of the Helena Rod and Gun Club for two days, during which time we examined that part of Flathead Lake, the Swan River, and made a trip across the country 7 miles to Swan Lake. Leaving the Flathead Lake region August 4, we returned to Helena, where we spent a day inspecting Hon. W. C. Child's bedrock drain, and then proceeded to Mammoth Hot Springs in the Yellowstone National Park. Here we secured a proper camping outfit, and started out August 7 for a tour of three weeks through the Yellowstone National Park and the little-known region in Wyoming lying south of the Park.

During this expedition we had as our guide Mr. Elwood Hofer, whose energy, intimate acquaintance with the region, and personal knowledge of the work already done by the Commission in the Park, made his services invaluable to us.

The objects of this trip were:

(1) In compliance with our instructions, we desired to visit all the waters of the Park in which plantings of various species of *Salmonidæ* had been made by the Commission in 1889 and 1890, to determine, if possible, the measure of success that has attended that work;

(2) A more thorough study of the streams of the Park than had hitherto been made was necessary to an understanding of the very interesting questions of geographic distribution which are there presented;

(3) It was desirable, as a part of the question of distribution, to visit the region at the headwaters of Atlantic and Pacific creeks, and to determine, if possible, the exact nature of the famous Two-Ocean Pass as a barrier to the distribution of fishes;

(4) We desired to make investigations with a view to discovering if there are not yet other waters in or near the Park that are without fish and the stocking of which might very properly be undertaken by the Commission; and

(5) We wished to examine various streams and springs in and about the Park with reference to the selection of a site for the location of a fish-cultural station, if any suitable could be found in that region.

It may be added here, that these explorations were very satisfactory from both the economic and scientific points of view, the results being among the most important obtained during the summer's work.

We returned to Mammoth Hot Springs at noon, August 25. The afternoon of that day and the day following were spent in examining the streams in that vicinity and at Cinnabar and Horr, just north of the Park line. On the evening of the 26th I went by rail to Bozeman, leaving Prof. Jenkins and Mr. Clapham to examine Botteler Springs, between Cinnabar and Livingston. After spending one day inspecting the streams and springs about Bozeman, I returned to Livingston, where I was again joined by Prof. Jenkins and Mr. Clapham. We decided here to close our investigations for the season.

ACKNOWLEDGMENTS.

In this connection I desire to express the thanks of myself and the other members of my party to the various gentlemen in Montana and Wyoming who assisted us in various ways in our work. Mention should first be made of Senator T. C. Power, who is greatly interested in the efforts of the Fish Commission looking toward increasing the value of the food-fishes of Montana. Senator Power took pains to acquaint the people of the State with the purposes of our visit, and through him we were enabled to meet many of the most prominent citizens, who rendered us assistance in many ways. At Helena numerous courtesies were extended to us by Maj. Robert C. Walker, secretary of the board of trade; also by Hon. William Muth and Hon. W. C. Child. At Deer Lodge we were able to make more thorough and extensive explorations than would have otherwise been practicable through the kindness of Mr. N. J. Bielenberg, Mr. Frank Conley, superintendent of the State prison, and Prof. Frank Traphagen, of the College of Montana. At Missoula we were assisted in visiting the various streams of that region by Hon. W. M. Bickford and Mr. E. A. Winstanley, and were shown favors by other gentlemen of that city.

We were enabled to visit the Swan Lake region through the kindness of Mr. Edward Harwood, of Demersville, and Hon. William Muth, who placed their small steamer at our disposal. Mr. Harwood accompanied us on all of our trips about this region and assisted us in many ways. I was able to make much more thorough investigations in the vicinity of Bozeman than would otherwise have been possible in the time at my disposal, through the kind and courteous assistance of Hon. O. P. Chisholm, Walter Cooper, esq., and Mr. W. A. Imes. To Capt. George S. Anderson, U. S. Army, acting superintendent of the Yellowstone National Park, we are under special obligations for the loan of blankets and other articles, which added greatly to the comfort of our trip through the Park. Capt. Anderson takes an active and intelligent interest in the efforts of the Commission to stock the Park with valuable food-fishes, and is ever ready to assist it in all proper ways. The opportunity to make the trip from Cañon Hotel to Horsethief Springs was due to the kindness of Mr. R. R. Cummins, who furnished free conveyance to the springs and back again to Mammoth Hot Springs.

REPORT OF THE INVESTIGATIONS.

ITINERARY.

July 7. Left Washington, District of Columbia, for Leadville, Colorado; was joined at Terre Haute, Indiana, by Prof. O. P. Jenkins and Mr. Burnside Clapham, and arrived at Leadville July 12.

July 13–14. Spent at the Government hatchery at Evergreen Lakes, near Leadville.

July 15. Left Leadville for Helena, Montana, where we arrived July 18.

July 20. Drove to McClellan and Prickly Pear creeks, east of Helena.

July 21. Went to Elliston, where we seined Little Blackfoot River.

July 22. Went to Deer Lodge; seined Cottonwood Creek and Deer Lodge River.

July 23. Started with teams and saddle horses for the headwaters of Dempsey Creek, returning July 25; examined Tincup Joe, Punch, Dempsey, and Race-Track creeks, and the lakes near Mount Powell, at the head of Dempsey Creek.

July 25. Went to Dillon.

July 26. Mr. Clapham went to Red Rock, where he seined the Red Rock River the next day.

July 27. Prof. Jenkins and I seined the Beaverhead River near Dillon. Went to Silver Bow in the evening and examined Browns Gulch Creek.

July 28. Went to Missoula; drove up Rattlesnake Creek several miles and examined it down to its mouth.

July 29. Drove to Big Blackfoot River.

July 30. Drove to Bitter Root River and Lolo Creek, about 12 miles south of Missoula.

July 31. Went to Ravalli, and drove from there to St. Ignatius Mission, where we examined Mission Creek; returned to Ravalli in the afternoon and seined Jocko River.

August 1. Took the stage for Flathead Lake, where we took the steamer for Demersville, on Flathead River, which we examined in the evening.

August 2. Went on the steam launch down the river to the mouth of Swan River.

August 3. Drove through the woods 7 miles to Swan Lake; examined the lake, river, and Depew Creek.

August 4. Returned to Ravalli and took train for Helena.

August 5. Drove to Mr. Child's ranch.

August 6. Went to Mammoth Hot Springs, Yellowstone National Park.

August 7. Started out from Mammoth Hot Springs equipped for a three-weeks' camping expedition. Traveled about 12 miles and camped at head of Beaver Lake.

August 8. Traveled 18 miles to Cañon Creek, where we camped. Prof. Jenkins and Mr. Hofer made a detour to examine Gibbon River above Virginia Cascade.

August 9. Traveled 9 miles to Nez Percé Creek, Prof. Jenkins and Mr. Clapham making a side trip to the junction of Firehole and Gibbon rivers.

August 10. Rode about 10 miles to Firehole River, just above Old Faithful, where we camped.

August 11. Traveled 16 miles up the Firehole River, across the Divide and to the outlet of Shoshone Lake, where we made our fifth camp.

August 12. Shoshone Lake to Lewis River, below the upper falls, 10 miles.

August 13. Lewis River across Crawfish Creek near Moose Falls to President Camp, on Snake River, 20 miles.

August 14. Crossed Snake River and proceeded southward to Jackson Lake, 12 miles.

August 15. Turned eastward and camped on Pacific Creek, 12 miles from Jackson Lake.

August 16. Followed up Pacific Creek 18 miles, where we again camped.

August 17. Followed on up Pacific Creek 7 miles to Two-Ocean Pass, where we spent the day.

August 18. Followed down Atlantic Creek to its mouth, crossed the Upper Yellowstone River, and camped on Thoroughfare Creek, 12 miles.

August 19. Traveled 18 miles to the mouth of the Upper Yellowstone River, camping near the mouth of Beaverdam Creek.

August 20. Traveled along east side of Yellowstone Lake 10 miles to the mouth of Meadow Creek.

August 21. Followed on down east shore of the lake to the Yellowstone River, crossed over, and went up to Lake Hotel for mail, the rest of the party camping at mouth of Pelican Creek.

August 22. Proceeded down Yellowstone River to the Grand Cañon.

August 23. I left the party here and went across the country to the Norris Basin, from which place I accompanied Mr. R. R. Cummins to Horsethief Springs, about 42 miles west. The rest of the party proceeded down Yellowstone River to the foot of Mount Washburn, where they camped.

August 24. Examined Horsethief Springs and returned to Norris Hotel. The main party traveled on to Blacktail Deer Creek.

August 25. All members of the party reached Mammoth Hot Springs at noon.

August 26. Rode to Reese Creek above Cinnabar. Took the train in the evening, Prof. Jenkins and Mr. Clapham stopping off at Fridley's to examine Botteler Springs, while I went on to Bozeman.

August 27. Examined streams about Bozeman. Returning to Livingston that night, I was joined there by Prof. Jenkins and Mr. Clapham, and we took the train for the east.

PHYSICAL FEATURES OF THE REGION EXAMINED.

The desirability of reaching as many places as possible in the investigations pertaining to the selection of a site for the hatchery required us to cover a much wider area in the season's work than would otherwise have been advisable. Nothing like a thorough survey of the entire region traversed was possible in the time which we had to devote to it.

In the measurement of the streams, the widths and depths given are the average for the distance through which we measured the current. The rate of the current was obtained by timing a floater, and the rate given is usually the average of the results of several tests. Usually the floater was timed for a distance of 50 to 100 feet. The measurements taken were under rather than over; hence the volume determined for each stream is believed to be slightly under the exact amount. The volume given is the number of gallons the stream discharges per minute.

The temperatures were taken with one of Wilder's standard Fahrenheit thermometers, and, unless otherwise stated, the temperature given is that of the water near the surface. The seining was done with two Baird collecting seines, one 15 feet, the other 30 feet long.

According to Dr. Hayden,* Montana is separated into two very unequal areas by the dividing range of the Rocky Mountains, which forms the southwestern boundary from the west line of Wyoming to the intersection of 45° 40′ north latitude and the 114th meridian. Here it suddenly bends eastward for some distance, and then runs north about 20° west to the northern boundary of the State. Extending from the mouth of the Yellowstone to the summit of the Bitter Root Mountains, about two-fifths belong to the mountain region, the remaining three-fifths consisting of broad, open plains lying east of the Rocky Mountain range. The mountain belt, which forms a broad margin along the western end, has probably an average width of 175 miles, running northwest parallel to the western boundary. Besides these two leading ranges and their interlocking spurs on the west slope, there are some minor ranges on the eastern side, which, though comparatively small in extent, are important in respect to the influence they have upon the course of the water drainage and the form and direction of the principal valleys.

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* U. S. Geological Survey of Montana and adjacent Territory, 1871.

In and about the Yellowstone National Park appears to be the great mountain nucleus of this region. Here the Bighorn, Yellowstone, Gallatin, Madison, Jefferson, Snake, and Green rivers have their origin. From this mountain center a number of short ranges run northward, giving direction to a number of streams. Along the southern border the Snow Mountains penetrate Montana for a short distance, compelling the Yellowstone River to make a grand detour in order to sweep around the northern flank. In the central portion are the Belt, Judith, and Highwood mountains, forming an irregular group of short and broken ranges, around which the Missouri sweeps to the northward before entering upon its long eastward stretch. These also have a nucleus where the Musselshell, Judith, Deep, and Shields rivers take their rise.

The mountains of this region, as a rule, are less rugged than those of Colorado. There are some very rough, rocky groups, such as the Grand Tétons, portions of the Main Divide southeast of Flathead Lake, and a number of peaks east of Yellowstone Lake. Instead of the rocky, jagged sides and serrated crests, we usually see here smooth slopes and rounded outlines.

According to Dr. Hayden, the elevation of both mountains and valleys of Montana is less than that of the great mountain belt of Colorado, Wyoming, Utah, Nevada, and New Mexico. The average altitude of the entire State is given as being 2,260 feet lower than that of the other States named, a difference regarded as the equivalent of seven degrees in latitude.

Climate.—Western Montana and northwestern Wyoming are among the most fortunate regions of America as regards rain and snow. According to Prof. Arnold Hague, "snow falls early in October [in the National Park region] and rarely disappears before June, and throughout the winter it is said to lie 6 feet in depth over the plateaus and higher regions of the Park."

A discussion of the forests and other vegetation will be given in detail in connection with the description of each stream or particular locality examined. It may be said here, however, that western Montana and Wyoming constitute a vast region which is for the most part covered with immense coniferous forests on the mountains, while here and there are a few large tracts with little or no timber, such as the plain at the south end of Flathead Lake, constituting the greater part of the Flathead Indian Reservation, and such valleys as those of the Prickly Pear and Deer Lodge. On the mountains the timber line is not far from 9,000 feet above sea level. At this height the dwarfed, scraggy spruce trees are mere bushes, not over a yard in length, and lie pressed flat upon the ground by the heavy snows. The forests are extremely heavy on the Big Blackfoot River, about Swan Lake, below Dempsey Lakes, and the region south and east of the Yellowstone National Park which has recently been added to the Park as a timber preserve by proclamation of President Harrison.

Drainage.—The whole State of Montana and that portion of Wyoming visited by us are drained entirely by the Columbia and the Missouri, the headwaters of those two great rivers having their rise on the Great Continental Divide, near which our investigations were chiefly confined. By far the greater part of Montana, nearly all that portion lying east of the meridian of 112° 30′, lies within the Missouri drainage area. In the northwest part of the State the divide lies more than a degree farther west, and in the southwest the Missouri drainage extends westward to the Idaho State line. The Missouri also drains all of northwest Wyoming excepting the southwest portion of the National Park and part of the region south of the Park. This part of Wyoming belongs to the Columbia River Basin, being drained directly by the Snake River and its tributaries. In general it may be said that the streams of the Missouri system flow in a northeast or northerly direction. Those tributary to Clarke Fork of the Columbia flow to the northwest, while the drainage into the Snake River or Lewis Fork of the Columbia is to the southwest.

Nearly all of these rivers and creeks are, of course, swift mountain streams; most of them have their rise in small lakes of clear, cold water, high up in the mountains—lakes which as yet are difficult of access and but little known. Many of these lakes are known, however, to be well supplied with trout, while others are wholly without any fish life whatever. From these mountain lakes the swiftly flowing, turbulent streams make their descent through rocky gorges and cañons to the valleys below. Ordinarily the beds of the streams are very rocky, but now and then are found more quiet reaches where the streams have sand or gravel beds as they flow through small mountain meadows. Then, at other places, there are rapids and cascades, and in many of the streams are found considerable waterfalls. The best illustrations of this are in the numerous magnificent falls found in the streams flowing from the great volcanic plateau constituting the larger part of the Yellowstone National Park. As the streams leave this immense sheet of rhyolite, they do so in great falls, such as those of the Yellowstone, Gibbon, and Lewis rivers. Others of the same nature are to be found in the country lying to the east of the National Park in the Clarke Fork of the Yellowstone, and other streams of that region. These falls, of course, serve as more or less effective barriers to the distribution of fish, and as a result many of the mountain lakes, though of the most suitable character so far as temperature, purity, and abundance of food-supply are concerned, are wholly barren of fish life of any kind. The larger streams are, as a rule, less swift, and have more sandy and gravelly beds. There are few, if any, sluggish streams in this region, and all are clear unless contaminated by mining operations.

The following is a classified list of the waters examined:

A.—Columbia River Basin.

I. *Clarke Fork:*
    1. Flathead River.
    2. Flathead Lake.
    3. Swan River.
    4. Depew Creek.
    5. Swan Lake.
    6. Post Creek.
    7. Mission Creek.
    8. Jocko River.

I. *Clarke Fork*—continued:
    9. Missoula River.
    10. Bitter Root River.
    11. Lolo Creek.
    12. Rattlesnake Creek.
    13. Hell Gate River.
    14. Big Blackfoot River.
    15. Little Blackfoot River.
    16. Deer Lodge River.

A.—COLUMBIA RIVER BASIN—Continued.

I. *Clarke Fork*—continued:
  17. Rock Creek.
  18. Tincup Joe Creek.
  19. Cottonwood Creek.
  20. Dempsey Creek; (*a*) Dempsey Lakes.
  21. Race-Track Creek.
  22. Peterson Creek.
  23. Silver Bow River.
  24. Browns Gulch Creek.

II. *Lewis Fork, or Snake River:*
  1. Shoshone Lake; (*a*) Heron Creek.
  2. Lewis River.
  3. Lewis Lake.
  4. Aster Creek.
  5. Crawfish Creek.
  6. Polecat Creek.
  7. Jackson Lake.
  8. Pacific Creek.
  9. Inness Lake.

B.—MISSOURI RIVER BASIN.

I. *Upper Yellowstone River:*
  1. Atlantic Creek; (*a*) Jay Creek; (*b*) Senecio Creek.
  2. Bridger Lake.
  3. Thoroughfare Creek.
  4. Escarpment Creek.
  5. Cliff Creek.
  6. Mountain Creek.
  7. Trapper Creek.

II. *Yellowstone Lake:*
  1. Beaverdam Creek.
  2. Columbine Creek.
  3. Meadow Creek.
  4. Pelican Creek.

III. *Lower Yellowstone River:*
  1. Blacktail Deer Creek.
  2. East Fork of Gardiner River; (*a*) Lava Creek.
  3. West Fork of Gardiner River; (*a*) Glen Creek; (*b*) Indian Creek; (*c*) Beaver Lake; (*d*) Twin Lakes.

III. *Lower Yellowstone River*—continued:
  4. Reese Creek.
  5. Botteler Springs.

IV. *Madison River:*
  1. Horsethief Springs.
  2. Gibbon River; (*a*) Cañon Creek.
  3. Firehole River; (*a*) Nez Percé Creek.

V. *Gallatin River:*
  1. Bozeman Creek.
  2. Bridger Creek; (*a*) Davies Springs.

VI. *Jefferson River:*
  1. Red Rock River.
  2. Beaverhead River.
  3. Bighole River.

VII. *Prickly Pear Creek:*
  1. McClellan Creek.
  2. Child's bedrock drain.

COLUMBIA RIVER BASIN.

STREAMS TRIBUTARY TO CLARKE FORK OF THE COLUMBIA.

Clarke Fork of the Columbia.—This name is of somewhat varied application. It originally meant all of that river having its sources in the numerous small streams coming down from the mountains east and west and uniting into one stream of considerable size in Deer Lodge Valley, and which runs from there north, west, and then northwest, until just beyond the boundary of the United States in longitude 117°30′ west, where it joins the Columbia at Fort Sheperd. Starting as a small stream on the divide near Silver Bow, flowing northward through the beautiful and fertile valley of Deer Lodge, and receiving on its way numerous smaller streams from the mountains between which it flows, it receives the Little Blackfoot River at Garrison, where it turns westward and continues in that general direction to the city of Missoula, 7 miles above which it receives the Big Blackfoot, a large tributary from the north.

All of that portion above the mouth of the Little Blackfoot River is now generally known as the Deer Lodge River. At the mouth of the Little Blackfoot it takes the name Hell Gate River, which it bears to the mouth of the cañon just above Missoula, where it again changes its name and comes to be known as the Missoula River. The Hell Gate River is sometimes, however, made to include all that portion lying between the mouths of the Little Blackfoot and the Bitter Root, the latter uniting with the main stream just below Missoula; this seems to be the more logical division. For the next 30 miles, or until joined by the Flathead River, it is known as the Missoula River. From the junction of these two streams, it continues northwest for about 80 miles through a well-wooded and magnificent cañon, and it is to this portion that the name "Clarke Fork" is now usually restricted. At the lower end of this cañon the river widens out greatly, forming the beautiful Lake Pend d'Oreille. At the outlet of this lake it begins to flow more slowly and quietly as the Pend d'Oreille River, which name it continues to bear until it joins the Columbia. Some 25 or 30 miles below Lake Pend d'Oreille there is a vertical fall of 8 or 10 feet, known as the Seniakwoteen Falls. Here the river is said to enter a narrow cañon, through which it rushes with such violence as to be wholly unnavigable, and then falls into the Columbia in a final plunge of 15 feet. The streams tributary to this great river are among the most important and most interesting of any of the Rocky Mountain region.

Flathead River.—This is quite a large river and is the outlet of Flathead Lake. It receives numerous small streams from the east, chief among which are Jocko River, Mission, Post, Crow, and Muddy creeks.

Jocko River.—We examined this stream near the railroad station at Ravalli, where it has an average width of about 40 feet and a depth of over 3 feet. The current is very swift—so swift, in fact, that it was with great difficulty that we were able to use the seine. The bottom is of coarse gravel with occasional clusters of large bowlders. There is little or no vegetation in the stream. The banks are lined in most places by quite a heavy growth of willows, alders, cottonwoods, and other bushes. In some places along the stream are small ponds, well filled with various species of *Algæ* and swarming with larval insect life. Frogs and tadpoles were also common, and in one place a number of larval salamanders (*Amblystoma tigrinum*) were taken. The water of the river is clear and cold, the temperature at 5 p. m., July 31, being 58°. The Jocko is a very pretty river, and is regarded by sportsmen as a very good trout stream. We found trout quite abundant, as shown by the fact that we caught as many as a dozen at one haul with the 15-foot seine. Blobs and whitefish were also common—the blobs being large and fine, while only young whitefish were taken. A few small specimens of the long-nosed sucker (*Catostomus catostomus*) were also taken. We were told that salmon trout are also found in the Jocko, but we saw no specimens.

Mission Creek.—This is a clear, cold stream, about 25 feet wide and 2 feet deep, having its rise in the Mission Mountains northeast of Ravalli, and flowing through the reservation to join the Flathead River. We examined it in the vicinity of the Mission of St. Ignatius, where we found trout of small size in considerable numbers. Post, Crow, and Muddy creeks are other small streams crossed by the stage road from Ravalli to Flathead Lake. Each of them is well supplied with trout. From Post Creek, which is somewhat larger than the others, we obtained specimens of the Columbia River sucker. It appears to be common in this stream and is no doubt found in the others of this region. At the Mission we saw several good-sized specimens that had been brought in by the squaws.

Flathead Lake.—This lake, the largest in the State, lies 35 miles northward from Ravalli. It is about 30 miles in length from north to south and averages perhaps 12 miles in width. It is a very beautiful sheet of water, whose shores at the south end are without timber, but toward the north dense forests of pine and other evergreen trees come down to the water's edge. In the northern portion are several small islands tolerably well timbered. This lake lies in what appears to be an immense glacial valley, the lake itself being due to the enormous moraine lying at its lower end and through which the outlet has been cut. It is said to be very deep in many places, but we have no exact data upon that point. The waters are clear and cool.

Flathead Lake is perhaps as well supplied with fish as any body of water in the State. Mountain trout are abundant, grow to a good size, and are readily caught; salmon trout or bull trout are also common and are caught at certain seasons in considerable numbers by trolling. The Columbia River sucker also occurs in the lake, while the two large minnows, the Columbia chub and the "squawfish," are very abundant. At the different landings where our steamer stopped we amused ourselves by fishing for these species with hook baited with pieces of beef. Each species bites very readily and each shows some game qualities. It seems to make but little difference with what the hook is baited. In one instance, a very large "squawfish" was taken with the fly by Mr. Clapham in Swan River, who felt sure he had a very fine trout until it was landed. So abundant are these two species, and so readily do they take the hook, that they often prove quite an annoyance to him who is fishing for nobler game. Whitefish are also found in the lake and, judging from the number of young that we saw, would seem to be common. However, those persons best acquainted with the lake, with whom we talked, did not know of its occurrence there; and, still more curiously, the Oregon chub is known as "whitefish" by those familiar with the lake.

Flathead River.—At its north end, Flathead Lake receives its principal affluent, Flathead River. This is a large stream coming into the United States from British America west of Chief Mountain Lake, flowing through the lake, and then continuing southwest to join the Missoula as already described. We ascended the Flathead River 28 miles to the new town of Demersville, where it is still a very large and very deep stream with a rather swift current. Some 30 miles above Demersville the current becomes more rapid, the head of navigation being at Columbia Falls, near where the three forks of the river unite. The fishes of this part of Flathead River are, so far as we know, the same as found in the lake. At Demersville we found mountain trout, squawfish, and Columbia River chubs quite common. Salmon trout are also caught there, but we saw none.

Swan River.—Nearly east from the mouth of the upper Flathead River is the Swan River. Big Fork, Swan River, Sweating-house River, and Sweating River are different names by which this stream is known on different maps, but it is more generally known to citizens of that part of Montana as Swan River. It rises on the Divide southeast of Flathead Lake, near the head of the Clearwater, a tributary of Big Blackfoot River. It flows about 80 miles northwest and then widens out to form Swan Lake. Narrowing again, it continues northward and then westward for about 20 miles further and then flows into Flathead Lake, only about 3 miles east of Flathead River. Swan River, at the outlet of Swan Lake, is about 75 yards wide and averages about 5 feet in depth. Surface temperature at 3 p. m., August 3, 65°.

The water is very clear and the current quite rapid throughout the greater part of its course between the two lakes. Not far below Swan Lake, and again not far above the mouth of the river, there are very picturesque rapids. The bed of the stream is, of course, very rocky for most of its length. In the more quiet places there is a little water vegetation. The region through which it flows is covered with a very heavy growth of timber, coming down to the water's edge.

Swan Lake is distant from Flathead Lake about 7 miles, though the distance by the river is three times as great. This is a very beautiful lake, 16 miles long and varying from less than a mile to 3 miles in width. This lake, with its clear and sparkling waters, surrounded on all sides by dense evergreen forests, and studded here and there with small, well-wooded islands, rivals in beauty and picturesqueness any that the writer has ever seen; and the beauty of the river from the lake to the outlet is unexcelled. This lake is said to be a favorite resort for swans, ducks, and geese, several pairs of the latter breeding each year upon the small islands.

Depew Creek.—Just below the foot of Swan Lake the river receives from the right a small stream known locally as Depew Creek. This little creek rises in springs and runs through very dense pine forests for its entire course, a distance of about 8 miles. It has a flow of less than 2,000 gallons per minute. The water is very clear and pure, with a temperature of 48° at 11 a. m., August 3. The fishes of Swan Lake and Swan River are, so far as known, the common trout, salmon trout, whitefish, Columbia chub, squawfish, blob, and the Columbia River sucker. We obtained specimens of all of these except the salmon trout.

Swan River, between the two lakes, is noted as one of the best trout streams in Montana, the greater part of the entire distance being exceedingly well suited for trout fishing.

Rattlesnake Creek is a stream about 20 miles long, rising in the mountains north of Missoula and flowing through a rocky but well-wooded cañon to the Missoula River at the town of that name. It is said to have its source in two small lakes, near a third lake which is drained by Clearwater Creek into Big Blackfoot River. The "divide" between this third lake and the two others is said to be of such a character that, with very little work, a ditch could be cut across which would result in bringing the surplus water of the third lake into those drained by the Rattlesnake, thus greatly increasing the volume of that stream. This is a very clear, cold stream flowing with a rapid current over a very rough bed of gravel and larger rocks, and containing very little water vegetation. The banks are lined with a heavy growth of trees, bushes, and vines, but this promises not to remain very much longer. The larger timber is being cut off rapidly for wood, which is floated down the stream. At the time of our visit, at least 3 miles of the stream was literally filled with an immense jam of cordwood which had been started down, and still above this we saw a constant line of sticks floating by to augment the large amount already in the jam. From the best information we could gain, all of this timber is being cut from Government land, and, whether by Government permission or not, it is certainly to be very greatly deplored.

We examined this stream throughout the last 10 miles of its course, and took measurements just above Missoula. Temperature, 54° at 5 p. m., July 28. Width, 30 feet; depth, 1⅝ feet; current, 2½ feet per second. This would give over 56,000 gallons per minute. This creek flows its entire course through Government land, except the last 2 miles. The city of Missoula gets its water supply from this stream, taking it out less than 2 miles above the mouth.

There seems to be an abundance of suitable fish food, many species of insect larvæ, etc., being seen at all places examined. The species of fishes found were the common trout, salmon trout, and blob. All of these were quite common, the salmon trout being, perhaps, the most abundant.

Big Blackfoot River.—This is one of the largest tributaries of the Hell Gate River, into which it flows at a point about 7 miles above Missoula. We examined it for the last 6 miles of its course. It is at least 100 yards wide and is very deep, so deep that the water, which is clear, appears very blue. Temperature at noon, July 29, 63°.

At Bonner, a mile or so above the mouth, is a very large sawmill, and the river for 3 or 4 miles above the mill is literally filled with logs which have been cut from the heavily timbered country through which the river flows and which were being floated down to the mill. Above this jam of logs the stream is open, but so deep and swift as to render seining wholly impossible except in occasional nooks and shallow places. This stream flows through a rocky gorge most of the way, there being but little bottom land. The mountains on either side are of highly metamorphic sandstone, and in most places densely timbered, but at the present rate of destruction it will not be many years until these magnificent forests are wholly destroyed, the mountains made barren, and the volume and beauty of the streams greatly diminished. An abundance of insect larvæ was found in several places, and the river is said to be a most excellent trout stream. We obtained specimens of the common trout, whitefish, blob, and one species of minnow (*Rhinichthys dulcis*). Frogs were not rare along the shore in suitable places.

Little Blackfoot River.—Examined on July 21, just above the town of Elliston. Temperature at 4 p. m., 55°; air, 71°. Width, 25 feet; depth, 2½ feet; current, 3 feet; volume, 84,375 gallons per minute. This is a good-sized stream, rising on the "divide" west of Helena and flowing westward to Garrison, where it joins the Deer Lodge to form Hell Gate River. The current is very swift, the bottom strewn with rocks of various sizes, and the banks are lined with willows, cottonwoods, and other small bushes. Below Elliston the water is muddied by mining operations, but above that place it is pure and clear.

Near the railroad bridge above town a small creek, averaging, near its mouth, 10 feet wide and 1 foot deep, flows into the Little Blackfoot. Its water is not so clear and is warmer (59°). In this we found an abundance of a small mollusk (*Limnæa palustris*) as well as various larval insects. In the river we found blobs and young whitefish abundant, and also took a few trout; while in the small creek we found trout of good size quite plentiful, a few whitefish, and an abundance of blobs, suckers (*Catostomus catostomus*), and minnows (*Rhinichthys dulcis*). Though we obtained no specimens, there is no doubt that the salmon trout also occurs in this river. Persons who have fished it frequently described to us two species of trout which they had taken here, one of which was quite certainly the salmon trout (*Salvelinus malma*). Frogs were not uncommon about the creek.

Cottonwood Creek.—Examined July 22 for the last 3½ miles of its course. Width, 20 feet; depth, 1½ feet; current, 3 feet; volume, 40,394 gallons per minute. Temperature at 3 p. m., 54°; air, 77°. This is a clear stream of considerable size rising in the mountains some 15 miles east of Deer Lodge. Flowing through rocky gorges in the upper part of its course, and through rather rough meadow land in the lower portion, it unites with the Deer Lodge River at the city of that name. The bed of the stream is throughout very rough and rocky, but the banks are lined with a heavy growth of cottonwoods, alders, and other small trees and bushes. It seems to be well supplied with insect larvæ and other suitable food for fish, and is a most excellent trout stream. The seining that we did here was very unsatisfactory, owing to the roughness of the bottom and the extreme swiftness of the current; however, we took over 30 trout and a great many blobs. Quite a number of trout were also taken with the fly. None of the trout taken weighed over half a pound.

In some very small ponds along the creek we found a great many frogs, and insect larvæ literally swarmed in these pools. A few snakes (*Eutænia* sp.?) were seen here. Quite a good deal of the water from Cottonwood Creek is used for irrigation, and the city of Deer Lodge receives its water supply from this stream. Up to the present time a little mining has been carried on along the upper course, but it has practically ceased now, and there is no great probability that the water of this creek will ever be in danger of contamination from that source.

Deer Lodge River.—This river has its origin in numerous small streams in the hills, chiefly to the westward of Butte City and on the divide, upon which also rise many of the affluents of Jefferson Fork of the Missouri. Flowing northward through a very beautiful and rich agricultural valley, it joins the Little Blackfoot River at Garrison, about 45 miles north of Silver Bow. We examined the Deer Lodge River throughout the greater part of its course. At Deer Lodge we found it to be 57 feet wide, 3 feet deep, and to have a current of 4 feet per second; this gives a flow of 307,800 gallons per minute. The temperature of the water at 10 a. m., July 23, was 59°; that of the air, 78°.

Throughout most of its course it has a very swift current. The bed of the stream is chiefly of coarse gravel and larger rocks. In some portions where the current is less swift the bed is made up of a constantly shifting mass of fine silt-like material, probably from the concentrators and reduction works at Anaconda and Butte. Throughout the entire length of this river the water is full of this solid matter in suspension. The amount of solid matter carried down by the Deer Lodge River from this source must be very considerable, and of course proves fatal to all kinds of fish life. We seined the river very thoroughly in the vicinity of Deer Lodge and did not find any fish whatever.

This stream is said to have been well supplied with trout and other fish, but none have been seen since the concentrators began operations. Other life was also scarce; no living mollusks or crustaceans and but few insect larvæ were seen. Upon a sandbar, below the town of Deer Lodge, we found a few dead shells of *Margaritana margaritifera* Linn., but careful search failed to discover any living specimens. The banks, usually low, are covered with a pretty heavy growth of alders, willows, and other small bushes. Except this fringe of trees along the streams, most of the Deer Lodge Valley is more or less rolling prairie or meadow land. In suitable places along the stream frogs were quite plentiful.

In its course from Silver Bow to Garrison the Deer Lodge River receives a great number of small streams from the mountains on each side of the valley. From the east come Browns Gulch, Silver Bow, Peterson, Cottonwood, and Freeze-out creeks;

while from the west the number is much greater, including Willow, Warm Spring, Lost, Modesty, Race-Track, Dempsey, Punch, Tincup Joe, and Rock creeks. Although these are all comparatively small streams, they are, with few exceptions, well filled with trout. Warm Spring and Silver Bow creeks are ruined by mining operations, and perhaps others are somewhat contaminated.

Rock Creek, which flows into Deer Lodge River near Garrison, is a good stream, rising in a large lake. A large reservoir has been made upon this creek about 12 to 15 miles above Garrison, and this is said to be full of trout.

Tincup Joe is a good-sized creek, coming in not far from Deer Lodge.

Dempsey Creek is perhaps the most interesting one of this region. This stream rises in several small lakes lying near Mount Powell, flows about 20 miles or more, and joins the Deer Lodge River about 8 miles above the city of that name. Through the kindness of Messrs. N. J. Bielenberg and Frank Conley, of Deer Lodge, we were able to make a trip to the lakes at the head of this creek. In company with these gentlemen and Prof. Frank W. Traphagen, of the College of Montana, and Mr. Thomas Morgan, of Deer Lodge, we made a three days' trip to these lakes. The first day we drove about 18 miles southwest from Deer Lodge and camped on Dempsey Creek, perhaps 15 miles above its mouth. That portion of the creek lying between our camp and the valley is very rocky and very swift. There are a few short, quiet reaches, but most of the course is made up of rapids and small cascades which make it a very picturesque stream. In the vicinity of our camp there are some small mountain meadows, and the creek is more quiet as it flows through them. Its average width here was about 12 feet, the depth 2 feet, and the current not over 1 foot per second. The water was, of course, very clear and cold, and well suited to trout. A little time devoted to fishing with the fly in the evening near our camp resulted in a string of about twenty very nice fish.

The next day we took saddle horses and followed on up the creek to the lakes at its head, a distance of 5 or 6 miles. This ride was a very difficult one, through dense, almost impenetrable pine forests, over rough, rocky ridges almost too steep for a horse to climb, and across marshy meadows in whose soft mud our animals were in danger of miring. The first lake we reached was about 5 miles from our camp; a few hundred yards to the right was a second one, and about the same distance to the left a third lake. Each of these contains perhaps three sections or less. About them the country is quite rocky, great bowlders and angular fragments of stone from the cliffs above being scattered here and there through the pine forests in which the lakes are set. These lakes are fed in great part from melting snows. Lying as they do around the base of the rocky peak of Mount Powell, they receive a multitude of little rivulets from a number of snow banks which linger in the gorges and cañons above until very late in summer, or even remain throughout the year. Indeed, right upon the shore of the third one of these lakes, we found a considerable bank of snow at the time of our visit, July 24. The lakes are in most places very deep, and the water clear and extremely cold. We neglected to take a thermometer with us on this trip, and consequently had no means of determining the temperature exactly, but it could not have been much above 40°.

In the first of these lakes we saw several trout, but though we fished quite a while they bit very poorly and we caught only a few. In the second lake we employed different methods with better success. At the lower end of the lake is the small stream which serves as an outlet to the lake. The beginning of this outlet is widened into a miniature bay, which has a fine pebbly bottom, and in which the water is not over a foot deep. A line of rocks has been made by some one so as to separate this corner from the lake proper. One or two places had been left open, thus permitting the fish to pass through. We found a great number of good-sized trout in this little bay, but nearly all ran out into deep water upon our approach. Withdrawing only a short distance we had to wait but a few minutes until they began to return. Very soon the spot was literally alive with trout, when we hurriedly closed the few openings in the dam. When thus shut in it was an easy matter to capture all we wished with a small seine which we had. In this way we soon caught about thirty very fine specimens, which constituted but a small portion of the number in the cove.

This little cove is evidently used as a spawning ground, and our visit was at the height of the spawning season. Nearly all the females were ripe with spawn. In several instances the eggs came freely from the fish as we handled them, and a great number of eggs were seen lying around among the fine granite gravel. The testes of the males were in many cases greatly distended with milt, and both the males and females were very brilliantly colored.

In the third lake, already mentioned, we found trout most abundant. As a result of less than two hours' fly fishing, we took about one hundred and twenty-five, each weighing a half pound or less. Quite contrary to our experience with the trout in the other lakes, we found them to bite freely, even voraciously, in this lake. It seemed to matter very little what was used for bait, whether artificial fly, a real fly, trout eye, or parts of bright-colored flowers. Several good catches were made with bright-colored leaves of a species of painted cup (*Castilleia*). All these fish were caught in shallow water along the shore, but the best fishing was always at the mouths of the little streams flowing into the lake. The fish were all in excellent condition, their stomachs were well filled with insect larvæ and insects; in a few cases I found a number of small bivalve shells. In several instances the stomachs contained quite a lot of fine gravel or sand, probably the broken-down cases of caddis worms. Wherever examinations were made, suitable food for trout was found in abundance.

Besides the three lakes which we visited, there are said to be eight others lying about the base of the peak of Mount Powell. So far as we are able to learn, these lakes have not received separate names, but are known collectively as Dempsey Lakes. They all lie at an elevation of about 9,000 feet above the sea, and most of them are drained by Dempsey Creek. The elevation of Mount Powell is about 11,000 feet.

Dempsey Creek, though a rapid stream, does not contain any falls that trout can not ascend, and the difficulty of reaching the lakes is, fortunately, so great that they are not likely to become fished out very soon.

Race-Track Creek is also an excellent trout stream. About two miles from its mouth we found it about 30 feet wide, 2 feet deep, and with a 3-foot current.

Browns Gulch Creek.—This is a small stream in Browns Gulch, near Silver Bow. We spent some time examining it about a mile north from the railroad station. We found it here to be not over 6 feet wide, 2 feet deep, and with a rather swift current. The water was not very cold, about 63°, and was somewhat muddy, owing to recent rains. The stream is lined by a good growth of willows, and runs through a narrow strip of meadow land bordered by low hills. A few trout and a great many suckers (*Catostomus catostomus*) and *Rhinichthys dulcis* were obtained here, and it was from this stream that we obtained the types of *Leuciscus gilli*. Small mollusks (*Limnæa palustris*), insect larvæ, and frogs were abundant.

This little creek flows into Silver Bow Creek near the railroad junction of that name. Silver Bow Creek is simply the name applied to the upper portion of Deer Lodge River. This comes down from the vicinity of Butte City, and its water has the consistency of thick soup, made so by the tailings which it receives from the mills at that city. No fish could live in such a mixture, and the fish in Browns Gulch are for the time being practically confined to that short stream.

The other tributaries of the Deer Lodge River are all small, but, with the exceptions already noted, are excellent trout streams.

Bitter Root River.—This is a fine large stream, reminding me very much of the beautiful Tippecanoe River, but it is about twice as large. It rises in the Bitter Root Mountains near the line between Idaho and Montana, flows north through the beautiful Bitter Root Valley, and empties into the Missoula River about 3 miles below the town. It is at least 75 miles long, its waters are clear and moderately cold, and the lower part of its course at least is over a bottom of sand and gravel covered toward the shores with a heavy growth of *Algæ* and other water vegetation. This stream is apparently quite deep and flows with a steady, moderate current. The banks are usually low and well wooded. Several bayous or small ponds were noticed along the west bank, and these are invariably filled with *Algæ*, a species of *Ranunculus*, and other aquatic plants.

Owing to the too great depth of the water we were not able to do any seining in the Bitter Root. Quite a number of specimens of *Mylocheilus caurinus* and *Ptychocheilus oregonensis* were obtained, however, by use of hook and line. These two species are evidently abundant in this river. Trout and "salmon trout" are also reported common, "salmon trout" weighing 12 to 14 pounds having been taken at the mouth of the river, according to Mr. E. A. Winstanley, of Missoula.

Lolo Creek.—This stream, also spelled "Lou-Lou," has its origin in the Bitter Root Mountains, on the Idaho State line, and flowing eastward for about 40 miles joins the Bitter Root River about 10 miles above its mouth, or about 12 miles southwest of Missoula. Like all other streams of this region the Lolo's waters are pure, clear, and cold. A mile or so above its mouth it was found to be about 35 feet wide, averaging perhaps 2½ feet deep, and flowing with a very rapid current. Temperature at noon, July 30, 56°. We examined it throughout the last mile but one of its course. Here it flows over gravelly bottom and between gravelly banks which are covered with a dense growth of alders, willows, and cottonwoods, with here and there a mossy patch or a stretch of meadow land. The stream, in some places along here, is broken up into several streams flowing in different channels, but they soon come together again. There are also a number of bayous, or more properly small ponds, occupying detached portions of former old channels of the stream. These were invariably filled with a species of *Ranunculus* (most probably *R. aquatilis trichophyllus*). They were often very deep, and the extremely muddy bottom rendered seining them a matter of no little difficulty.

The Lolo is one of the very best trout streams in western Montana. During the time we seined we obtained numerous fine trout, also a good many blobs and young whitefish. In the ponds we found *Catostomus catostomus* and *Ptychocheilus oregonensis* very common.

As already stated, the stream formed by the junction of the Deer Lodge and the Little Blackfoot is called Hell Gate River. It bears this name to the mouth of the cañon just above Missoula River, or sometimes to the mouth of the Bitter Root, where it becomes known as the Missoula River, by which latter name it is known for 30 miles or more, or until it is joined by the Flathead River.

Hell Gate River (and its continuation, the Missoula) being composed largely of the muddy waters of the Deer Lodge and the lower Little Blackfoot, is, of course, a rather muddy stream. By the time Missoula is reached the amount of solid matter in suspension is probably not enough to prove wholly destructive to fish, though there is no doubt that the number of fish in the river even here is very greatly reduced on account of this contamination. It is greatly to be regretted that something can not be done to prevent such destruction of these fishing streams. The Hell Gate River flows through a very rough, rocky cañon (whence the name) and is quite a large stream. The mouth of the cañon is just above Missoula; below there the stream flows through a broad valley.

So far as we were able to determine, there are no natural obstructions anywhere above Lake Pend d'Oreille in this river system—the Clarke Fork of the Columbia and its tributaries—which interfere seriously with the free movement of fishes. There are certainly no falls in the larger streams, and we know of none of any importance in any of the smaller ones; and the only artificial obstructions are those already mentioned, the great drifts of cordwood in the Rattlesnake and sawlogs in the Big Blackfoot. The contamination of the Silver Bow, Deer Lodge, the lower Little Blackfoot, the Hell Gate, and the Missoula by the mills at Butte and Anaconda tends to drive fish from these streams. It is quite certain, however, that Seniakwoteen Falls, below Lake Pend d'Oreille, and the falls at the mouth of Clarke Fork interfere with the further ascent of salmon, and it is possible that they prevent it altogether.

STREAMS TRIBUTARY TO LEWIS FORK OF THE COLUMBIA.

Snake River.—This is the name now usually applied to what was once known as Lewis Fork of the Columbia; it is, however, on many maps, called the Shoshone River. This river is more than 900 miles long, and is one of the most important of the Pacific coast streams. The only waters of this basin that we examined are in the southwest corner of the Yellowstone National Park and the region immediately south of the Park—the extreme upper courses—the very beginnings of the Snake River. About one-fourth of the area of the Park is drained by streams which unite to form the Snake River. Most all of these have their origin in several picturesque lakes which rest on, or are surrounded by, the great bed of rhyolite which forms the floor of this plateau region. Among the most important of these lakes are Shoshone, Lewis and Heart, the first two of which were visited by us.

Shoshone Lake.—We reached this lake from the Upper Geyser Basin, from which it is distant about a dozen miles to the southeast, across the "Great Continental Divide." The trail crosses the Divide much nearer the lake than the Geyser Basin, and from the crest the lake can be plainly seen to the south. The elevation of this lake is 7,740 feet. Its shape is somewhat like that of the letter T, the upright and the cross-pieces being each pretty heavy, and the letter being inclined very greatly to the right. The portion corresponding to the upright part of the T is very much constricted at the upper end. According to Mr. Gannett, topographer of the U. S. Geological Survey, the greatest length of Shoshone Lake is 6½ miles, the greatest width 4½ miles, while the constricted portion is but half a mile across, and its area is about 12 square miles. There are but few streams flowing into this lake, and they are all small. At the western end is Shoshone Creek, a small stream running through the Shoshone Geyser Basin, a cluster of hot springs and geysers discovered in 1872 by Dr. C. Hart Merriam and others of the U. S. Geological Survey. At the north end there is a small stream called Heron Creek, which drains a considerable area on the south slope of the "Divide," lying immediately north from this part of the lake. At the time of our visit, August 11, this stream was very small, not over 3 feet wide and 1 foot deep at the outlet, but back a little distance it widens out a good deal, and there is scarcely any current. This creek runs for the last few miles of its course through low, somewhat marshy meadow land. The water is clear, but not very cold. the temperature at 3 p. m., August 11, being 63.5°.

From the mouth of Heron Creek we traveled down the east shore of the lake (*i. e.*, across the top of the T) to the outlet. The distance is about 5 miles through the heavy evergreen forest which covers the bold, in places precipitous, shores to the water's edge. The view of the lake from this trail is a most charming one, for Shoshone Lake is certainly one of the gems of the Rocky Mountains, and the setting could scarcely be improved. (See Pl. VI.) Its shores, nearly everywhere bold and commanding, are densely wooded; the beach is of very clean gravel, and the water is clear and pure. The temperature at the surface near shore was 66°, at 3 p. m.

The outlet of Shoshone Lake is called Lake Fork or Lewis River. This is a very pretty stream of clear, pure water flowing with a rather rapid current for 3 miles in a direction a little east of south, and then expanding into Lewis Lake.

Lewis Lake.—This is another beautiful sheet of water, 20 feet lower than Shoshone Lake. It is, however, much smaller, its length being but 3 miles and its width not greater than 2 miles. It is essentially the same kind of lake as Shoshone, and, like it, was totally without fish life of any kind until stocked by the U. S. Fish Commission in 1890 with Loch Leven and lake trout. We camped the night of August 11 at the outlet of Shoshone Lake, where we seined the lake and the river repeatedly, but found no fish, though plenty were found at the upper end of the lake, as stated elsewhere in this report. The river at its beginning is about 50 feet wide, 1⅔ feet in average depth, and has a 2-foot current. Temperature at 8 a. m. was 59.5°; air, 56°.

From our camp at the foot of Shoshone Lake we rode through the heavy woods around the east shore of Lewis Lake, to a point on Lewis River just below the mouth of Aster Creek, where we camped again. Just above our camp are the Lewis Falls. These falls are very beautiful. There is first a vertical descent of about 20 feet, then a very steep rapid or cascade of 50 or 60 feet. It does not seem possible that fish could ever get up these falls. Lewis River here is about 75 feet wide, averages 1¼ feet deep, and flows with a 2-foot current. Its temperature at 8 a. m., August 13, was 65.5°, the air being 66°.

Aster Creek is but a small stream, 12 feet wide, ¾ foot deep, and having a current of nearly 2 feet per second. It rises in the Red Mountains west of Heart Lake and flows nearly due west. Its temperature was 58°.

We seined Lewis River from the falls downstream for some distance, but found no fish of any kind. Mr. Hofer whipped the stream very thoroughly for a mile or more, but not a trout rose to the fly. We also seined Aster Creek from its mouth upstream several rods, but saw no evidence of the presence of any fish. It is quite certain there are none here, and it is equally certain that it is not these falls that keep fish from entering Lewis and Shoshone lakes. These facts led us to make an attempt to reach a fall lower down the river, the existence of which had been reported by hunters, but about which little or nothing seemed to be certainly known. Next day we traveled on southward, Prof. Jenkins and Mr. Hofer making a detour to the left of the trail and following more closely down the right bank of the river. They found the cañon of Lewis River in this part of its course very wild and picturesque. (See Pl. XVII.) The walls are in many places quite high and vertical. About halfway between the Upper Falls and the mouth of Crawfish Creek, they came upon a very beautiful fall of considerable size. The stream is divided by a small island into two parts, the larger portion of the water flowing around to the right of the island. This part was estimated to be at least 50 feet wide and to fall almost perpendicularly at least 30 feet, then descend about 20 feet more in a very steep rapid, in which the stream widens out very much. That part of the stream passing around to the left of the small rocky island is about 8 feet wide, and it comes down in a series of very steep cascades and two principal falls, each apparently vertical. Both Prof. Jenkins and Mr. Hofer regard it as highly improbable that fish can ever ascend these falls. Mr. Hofer fished with the fly a short time just below these falls and found trout abundant. In a few minutes he landed six very fine fish, the largest measuring 14 inches in total length. A great many smaller ones were seen. So it may be considered as settled that these lower falls of Lewis River are the first impassable barrier that the fish meet in their efforts to ascend to Lewis and Shoshone lakes.

Crawfish Creek.—A few miles below the Lower Falls, Lewis River receives from the right a good-sized tributary known as Crawfish Creek. This stream rises on the Pitchstone Plateau, flows perhaps a distance of 10 to 15 miles southeast, and joins Lewis River just before that stream unites with Snake River. This is just inside the southern boundary of the Park. Where the trail crosses, Crawfish Creek is 27 feet wide, 1 foot in average depth, and has a slow current—100 feet in 1 minute. The water is very warm—81° at noon, August 13. There must be warm springs somewhere along its upper course. The water is clear and seems to be pure. The banks here and for some distance above the ford are low and marshy in some places. The bed of the stream is gravelly, the rocks generally being coated with *Algæ.* Water vegetation was abundant in places. Just below the ford, Crawfish Creek becomes very rapid and continues so to its mouth, about 1½ miles away. The banks are steep and rocky and covered with a heavy pine forest. A short distance below the ford are Moose Falls, where the creek falls in one vertical plunge a distance of at least 30 feet. We examined the creek very carefully both above and below the falls. No fish were found above the falls but trout were taken below. The bed of the stream below the falls is extremely rocky, rendering the use of the seine almost impossible.

Crawfish (*Astacus gambelli*) were found to be very common both above and below the falls. Crawfish were not found in any other stream of the entire region explored by us, except in Snake River and Jackson Lake south of this place.

Polecat Creek.—This is a stream much the same size as Crawfish Creek, and not unlike it in other particulars. It rises just within the Park limits, flows south across the line, and empties into Snake River at President Camp.

Snake River.—The old Sheridan trail, the trail we followed from the Upper Geyser Basin, crosses Snake River at what has come to be known as the "President's Camp." This is about 2 miles south of the south line of the Park. The river here flows through a wide meadow, grassy and open on the right side, on the other covered with a heavy growth of chapparal. It is a beautiful river with clear water and gravelly bottom. At the camp, the bank is 3 or 4 feet high, but a little lower down the shores are low and composed of gravel and sand. In the main stream the current was pretty strong, but there were some quiet nooks and coves where the water was filled with various species of *Algæ*. The water was 62.5° at 9 a. m., August 14.

Fish were found to be abundant in the river here. Many fine trout were taken, mostly with the hook. Blobs, young whitefish, suckers (*Catostomus ardens* J. & G.), and minnows (*Leuciscus atrarius*, *Leuciscus hydrophlox*, and *Rhinichthys dulcis*) were found, the whitefish, Utah chub, and suckers being especially abundant. Most of these were gotten from a deep, quiet nook filled with *Algæ* right at the camp, and nearly all were found covered with small dark specks, probably a parasitic protozoan. Crawfish were found to be common here.

Jackson Lake.—From President Camp we crossed Snake River and traveled south about 12 miles to Jackson Lake. This is a fine body of water about 15 miles long by 3 or 4 miles wide. Below our camp a short distance is Marymere, the mountain home of Mr. John D. Sargent. Across the lake to the southwest are the Téton Mountains, rising from the margin of the lake and their rugged peaks piercing the clouds. These peaks are very rough and wild. The pinnacles are very steep and storm-splintered; beds of snow that never disappear, and which may be glaciers, fill the gorges. There is no grander mountain group in America than the Grand Téton with the peaks which environ it.

Snake River flows into Jackson Lake at its upper end and out again below. About the upper end of the lake there is a good deal of low-lying meadow land. On the left it is bordered by low hills, while on the right the shore is precipitous and rocky. Near the upper end a small creek flows into it, in which we found suckers, minnows, blobs, trout, and crawfish. This creek, where we crossed it, is 6 or 8 feet wide and 2 or 3 inches deep. It has but little current. There are some very deep holes in which fish were common. The water was not cold, 67.5° at noon, August 14. The lake is rather shallow on the eastern side, but is said to be very deep on the west. The temperature at the surface was 62° at 9 a. m., August 15.

In the Tenth Annual Report of the Director of the U. S. Geological Survey, Capt. C. E. Dutton says, in writing of Jackson Lake and Snake River, which drains it:

> The present area is not far from 40 square miles, while its watershed is between 750 and 800 square miles.
>
> Snake River at low stages carries more than 3,000 second-feet of water. Its sources in Yellowstone Park and in the Téton and Wind River ranges are regions of large precipitation, which yield many perpetual streams. Emerging from the mountains the Snake flows out into an immense plain, 250 miles in length and from 50 to 100 miles in width. A large portion of this plain has been overflowed, in comparatively recent geological times, by extravasations of basaltic lava, much of which is still an expanse of barren rock, while some of it is imperfectly buried in drifted sand and soil. (Part II, p. 106.)

According to Mr. Sargent, Jackson Lake literally swarms with suckers in the spring, and trout are also abundant. We were not able to take any suckers or trout; nor did we think it worth while to use the seine in the lake. We fished some time with hooks, however, and caught nine large Utah chubs (*Leuciscus atrarius*). Crawfish were also found here.

Pacific Creek.—From Jackson Lake we traveled across the mountains eastward about 12 miles to Pacific Creek. Our first camp on this creek was about 8 miles above its mouth. It is here a good-sized creek, 37 feet wide, 14 inches deep, and with a very swift current (5 feet per second). The bed of the stream is very rocky, being made up of water-rounded glacial bowlders of small size. The banks are low and level, covered with a fair growth of bushes, and further back a good growth of pines. Trout were found to be quite abundant, no less than thirty very fine ones being taken with the fly in a short time. Most of these ranged in length from 10 inches to 17 inches; one very fine specimen, 19 inches in total length, was taken by Prof. Jenkins. Several very young trout and a few very small blobs were taken with the seine. Fish food seemed abundant. Numerous caddis-worm cases formed of bright-colored granite pebbles were found. No crawfish or mollusks were seen. The water is clear and cold, the temperature at 4 p. m., August 15, being 62°; at 8 the next morning, when the air was 50°, the water was 49°.

The next day we followed up the narrow valley of Pacific Creek for about 18 miles and camped about a mile above Inness Lake. We found Pacific Creek here very much reduced in size, it being not over 10 feet wide, 6 inches deep, and having a 2-foot current. Temperature at 5 p. m.: water, 59°; air, 66°; at 6:30 a. m. the air was 38°; at 9:15 the air had warmed to 62°, while the water was 50°. A small branch at our camp was somewhat colder, the thermometer indicating 48° when the air was 62°. About 2 miles below this camp Pacific Creek is joined by Mink Creek, which, being the larger of the two, should be regarded as the main stream. Trout were found to be abundant in Pacific Creek here, but all individuals seen were small. Insect larvæ and other suitable food for fish were common.

Inness Lake is the somewhat uncertain name of a peculiar lake lying near Pacific Creek, about 1 mile below this camp. So far as I can learn, no name has been given to this lake by the U. S. Geological Survey, but "Inness Lake" is the name by which it is known to Mr. Hofer. It is about 3 miles long and ½ mile wide. It seems very deep in two crater-like depressions, but is rather shallow elsewhere. One shallow area was noticed near the center. A part of the bed of the lake and a portion of the shore at least are of limestone rock. The lake is surrounded on most sides by low marshy meadow. Its outlet is into Pacific Creek. Trout are very abundant in this lake. There was scarcely a moment when we were passing from one end to the other that one or more trout were not seen rising to insects upon the surface of the water.

The mountains about here are, in most part, covered with heavy coniferous forests. There are, however, among the ridges and upon the sides of some of the mountains, small but very beautiful grassy mountain meadows. The journey from Jackson Lake up Pacific Creek, while rather rough and difficult, is not attended with any hardships or danger. The chief difficulty is in getting through the fallen timber.

TWO-OCEAN PASS.

The next day, August 17, we traveled 6 miles farther up Pacific Creek and came to the famous Two-Ocean Pass. The importance of this pass justifies more than a brief notice. I have therefore collected all the published data regarding it that I could find. The first printed reference to this pass seems to be that made by Capt. W. F. Reynolds in his report of the exploration of the Yellowstone in 1868, page 11. Capt. Reynolds says:

> Bridger also insisted that immediately west of where we made our final attempt to penetrate this singular valley [Yellowstone] there is a stream of considerable size which divides and flows down either side of the watershed, thus discharging its waters into both the Atlantic and Pacific oceans. Having seen this phenomenon on a small scale in the highlands of Maine, where a rivulet discharges a portion of its waters into the Atlantic and the remainder into the St. Lawrence, I am prepared to concede that Bridger's "Two-Ocean River" *may* be a verity.

Capt. Jones, of the U. S. Engineers, in his report of a Reconnaissance of northwestern Wyoming, published in 1875, gives a description of the pass. He seems to have been the first to describe this interesting place from actual observation. He says:

> At this divide occurs a phenomenon, probably the one referred to by the early trappers as the "Two-Ocean Pass." Marching at the head of the column where the trail approached the summit I noticed that the ribbon of meadow, in which the stream lay we had been following, suddenly dropped away in front of us with a contrary slope. I could still see the stream threading it and for a moment could scarcely believe my eyes. It seemed as if the stream was running up over this divide and down into the Yellowstone, behind us. A hasty examination in the face of the driving storm revealed a phenomenon less startling perhaps, but still of remarkable interest. A small stream coming down from the mountains to our left I found separating its waters in the meadow where we stood, sending one portion into the stream ahead of us and the other into the one behind us, the one following its destiny through the Snake and Columbia Rivers back to its home in the Pacific; the other through the Yellowstone and Missouri, seeking the foreign waters of the Atlantic by one of the longest voyages known to running water. On the Snake River side of the divide the stream becomes comparatively large at once, being fed by many springs and a great deal of marsh.

Capt. Jones gave a map of the pass, a copy of which I give in Fig. 1, Pl. II.

In October, 1878, Dr. Hayden visited the pass, an account of which he gave in Article XV, Bulletin 2, U. S. Geological and Geographical Survey of the Territories, as follows:

> This pass is located about longitude 110° 00′, and latitude 44° 05′. Atlantic Creek is a branch of the Upper Yellowstone River. The party with which the writer was connected passed up the east side of the Yellowstone Lake to the mouth of the Upper Yellowstone River, and thence up the valley of that stream about 30 miles to what may be called the Three Forks, near Bridger's Lake. The east [west] fork bears the name of Atlantic Creek.
>
> From the Three Forks the party passed up the valley of Atlantic Creek to the southwest, for the most part over a grassy valley, which was inclosed between vertical walls of volcanic breccia 1,000 to 1,200 feet in height. This valley is purely one of erosion. The breccia itself is of very modern age, probably quaternary date, and the wearing out of this great groove must have been an exceedingly modern event. So far as can be seen from the summit of the mountains on either side no divide can be observed. The erosion seems to have produced a gentle slope on either side of the watershed. At the summit, not over 10 miles from the junction of Atlantic Creek with the Upper Yellowstone, the elevation, 8,081 feet, is not more than 150 feet above the valley of the main stream. The valley is at first quite narrow, but it gradually expands into an open, grassy meadow, which, near the pass, becomes one-third of a mile in width, and gradually closes up again into a cañon on the Pacific slope. So obscure is the drainage that we camped the night of October 3, 1878, within a fourth of a mile of the water divide, but did not perceive it until we commenced our march the following morning.

Bull. U. S. F. C. 1891. Fish-cultural Investigations in Montana and Wyoming. (To face page 24.) **PLATE II.**

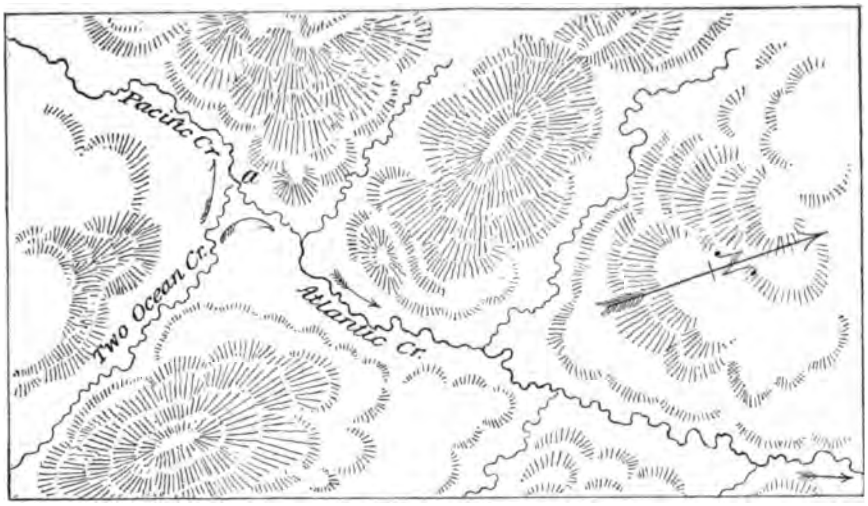

FIG. 1. CAPT. JONES'S MAP OF TWO-OCEAN PASS.

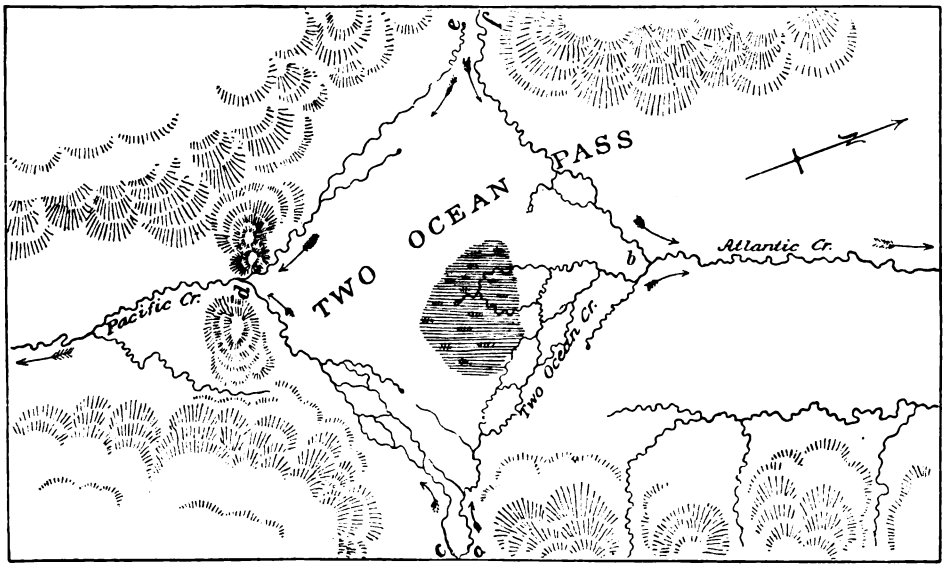

FIG. 2. DR. HAYDEN'S MAP OF TWO-OCEAN PASS.

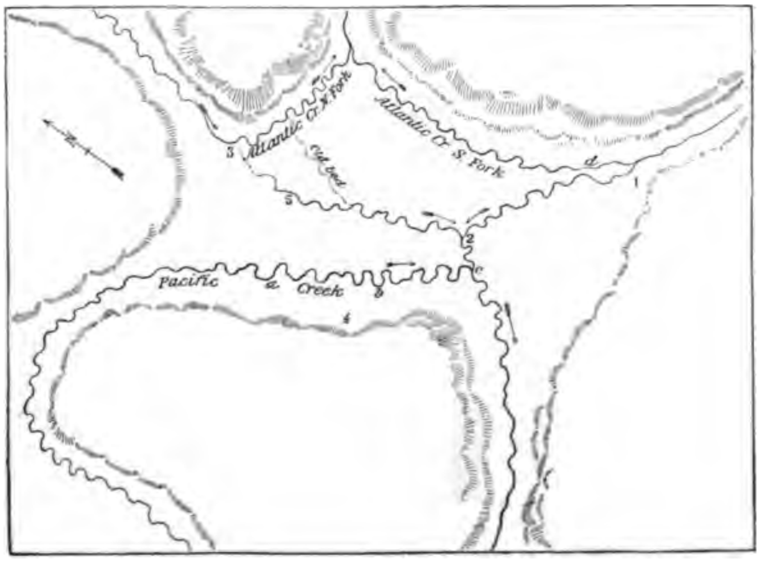

FIG. 3. TWO-OCEAN PASS, FROM SKETCH MADE BY PROF. EVERMANN.

> The conditions are as follows: The summit of the pass for a distance of about half a mile is so nearly level that a marsh is formed, which in times of high water becomes a small lake. A portion of the waters from the surrounding mountains accumulates in the marshy meadows and gradually gravitates from either side into two small streams, one of which flows to the northeast, the other to the southwest. On the east side of the divide there is a depression or gorge in the mountain, which is occupied by a small stream that at the time of our visit flowed in a well-marked channel toward the northeast into Atlantic Creek.
>
> This is the well-known Two-Ocean Creek. At the base of the mountain side (*c*), a small stream rises from a sink hole or spring, which at the time the writer saw it (October 4) was nearly dry, and but little water was running in Two-Ocean Creek (*a*). This spring hole was not separated from the latter creek more than 6 feet, and a small dry channel connecting it with *a* showed that in times of high water a portion of the water that started down the mountain channel (*a*) broke over the side into the spring hole (*c*), and flowed thence through channel *c* to the Pacific. Lower down in the Two-Ocean channel are two places (shown by dotted lines), where there are two old channels connecting in time of high water with channel *c*, showing that a portion of the waters that started down the mountain side for the Atlantic was diverted toward the Pacific. On the opposite side of the pass there is a similar depression in the breccia wall, down which, at the time of the melting of the winter's snows, much water flows.
>
> The points *b* and *d* are close together, and the waters of the grassy meadows, which lie between them, probably separate, a part taking one direction and a part the other. The little lake or marsh in the center, of course, furnishes a supply or reservoir for both. (See Dr. Hayden's map, Fig. 2, Pl. II.)

In September, 1884, Two-Ocean Pass was visited by Mr. Arnold Hague, of the U. S. Geological Survey, but he was prevented by a severe snowstorm from making any detailed observations. In Powell's Sixth Annual Report, p. 56, Mr. Hague says:

> I determined, however, to follow up Pacific Creek and take as direct a course as possible to its sources in the meadows described by Dr. Hayden. From the information I had gathered and the erroneous character of the maps I was prepared for a difficult bit of travel. I found, to my surprise, with the exception of 1 or 2 miles of rough country, that the stream could be followed without any serious hinderance to its source in the broad meadows high up in the mountains. From this same meadow a small stream, known as Atlantic Creek, flows eastward and empties its waters into the Upper Yellowstone.
>
> Unfortunately, we were caught on the summit in a severe snowstorm, although early in the month of September. Snow to the depth of 15 inches covered the ground. This not only caused a delay, but prevented us from determining accurately the conditions governing the supply and discharge of the waters. It is probable that the divide between Atlantic and Pacific creeks is but a few inches in height.
>
> The conditions observed here are not unlike those seen in many places in flat, plateau-like country, the difference being that here they are on a grander scale and more than usually striking and impressive. The place is one of great beauty. If the Park limits should be extended to the 44th parallel, Two-Ocean Pass will be within the reservation.

From the above it appears that this interesting pass was evidently known to the famous guide, Jim Bridger; that the first account written by one who had seen it is that given by Capt. Jones, who visited it during a driving storm September 3, 1873; that the next to visit it was Dr. Hayden, in October, 1878, who, like Capt. Jones, approached it from the Yellowstone side; and that it was again visited by Mr. Hague, in September, 1884. Mr. Hague reached the pass from Jackson Lake by way of Pacific Creek at a time when the pass was covered with snow. Besides those who have published accounts of their visits, Two-Ocean Pass has been visited several times by our guide, Mr. Elwood Hofer, within the last few years. The route traveled by our party was essentially the same as that followed by Mr. Hague. We arrived at the pass on Monday morning, August 17, and remained until 10 o'clock the next morning. This gave us ample time to make a careful examination of the remarkable conditions which obtain here. Reference to the frontispiece and the accompanying diagram (Fig. 3, Pl. II), from sketches made on the ground, will assist very much in understanding the description which follows.

Two-Ocean Pass is a nearly level piece of meadow land, surrounded by rather high hills except where the narrow valleys of Atlantic and Pacific creeks open out from it. Running back among the hills to the northward are two small cañons; on the opposite side is another cañon of the same character. Down these cañons come the three main streams which flow through the pass. The extreme length of the pass from east to west can not be much less than a mile, while the width from north to south is perhaps three-fourths of a mile. From our camp at *4*, just on the border of the meadow, an excellent view of the pass and its surroundings could be had. Just in front was Pacific Creek. Following it upstream for more than a mile above our camp, we found it to head west of the pass, then follow down a rocky cañon in a general northerly direction before finally turning somewhat abruptly to the southward just before entering the pass. The course is then southward across the western border of the meadow until a short distance to the right of our camp, when it turns suddenly west and leaves the pass through a narrow, grassy valley.

Atlantic Creek was found to have two forks entering the pass. At the north end of the meadow is a small wooded cañon down which flows the North Fork of Atlantic Creek. This fork hugs the border of the flat very closely, and at *3* turns rather abruptly to the east. At *c* we found a small tributary stream coming into Pacific Creek from across the meadow. Following up this stream we found it to start in a spring at *5*; but above this spring and connected with it we found a well-marked, dry channel, with gravelly bottom and distinct banks. This we followed to its source and found it to branch off from the North Fork at *3*. Very recently a green pine tree had fallen across this channel right at its origin in such a way as to completely dam it, thus throwing all the water back into Atlantic Creek. Only a little effort was needed to clear away the tree and the rubbish that had accumulated against it, and very soon a good portion of Atlantic Creek was flowing down the old channel to Pacific Creek. The distance from *3* to the spring, *5*, is about 1,000 feet, and the slope is very gentle. This, together with the fact that the ground throughout most of the distance was quite dry and took up water rapidly, caused the water diverted into the old channel to travel very slowly, and not until the next morning had it reached and connected with the running water at the spring. Mr. Elwood Hofer, our guide, traveled through this pass in September, 1890, at which time he says there was a continuous stream of water from point *3* to Pacific Creek by way of this old channel.

The South Fork of Atlantic Creek comes down a cañon to the right, skirting the brow of the hill a little less closely than does the North Fork. The phenomenon discovered on the north side was found to be repeated on this. At *1* an old channel was found branching from the South Fork and running toward Pacific Creek. It had also been dammed by a dead tree falling across right at its place of branching from the main stream, turning all its water back into Atlantic Creek. Putting a few rocks in the main stream and clearing away some of the rubbish resulted in sending at least 30 miner's inches down the old channel to *2*. This old channel runs along pretty close to the main stream for some distance, at one place, *d*, coming within a few feet of it. Across this narrow strip is another old bed through which water would be made to flow by a rise of a very few inches in Atlantic Creek. The old channel, beginning at *1*, was found to connect with the one from the other fork at *2*, and by the next morning a good-sized stream was flowing from the South Fork of Atlantic Creek into Pacific Creek. The lower portion of this channel contained a little seepage water, and it is certain a live stream had been flowing through it earlier this season.

Besides the old channels already mentioned there are evidences of several others which, during even ordinary water, would connect the two creeks. As already stated, the pass is a nearly level meadow, covered with a heavy growth of grass and many small willows 1 to 3 feet high. While it is somewhat marshy in places, it has nothing of the nature of a lake about it. Of course, during wet weather the small springs in the meadow would be stronger, but the important fact is that neither Atlantic nor Pacific Creek rises in the meadow. Atlantic Creek, in fact, comes into the pass as two good-sized streams from two different directions and leaves it by at least four channels, thus making an island of a considerable portion of the meadow.

Pacific Creek is a strong stream long before reaching the pass, and its course through the meadow is well fixed, but not so with Atlantic Creek, The west bank of each fork is liable to break through almost anywhere and thus send a part of its water across to Pacific Creek. It is probably true that one or more branches connect the two creeks under ordinary conditions, and that in times of high water a very much greater portion of Atlantic Creek flows across to the other. At any rate, it is certain that there has been, and usually is, a free waterway through Two-Ocean Pass of such a character as to permit fishes to pass easily and readily from the Snake River over to the Yellowstone—or in the opposite direction. Indeed, it is possible, barring certain falls, for a fish so inclined to start at the mouth of the Columbia, travel up that great river to its principal tributary, the Snake, continue on up through the long, tortuous course of that stream, and, under the shadows of the Grand Tétons, enter the cold waters of Pacific Creek, by which it could journey on up to the very crest of the Great Continental Divide, to Two-Ocean Pass; through this pass it may have a choice of two routes to Atlantic Creek, where it begins the journey downstream; soon it reaches the Yellowstone River, down which it continues through Yellowstone Lake, then through the lower Yellowstone out into the turbid waters of the Missouri; for many hundred miles it may continue down this mighty river before reaching the Mississippi, the Father of Waters, through which it may finally reach the Gulf of Mexico—a wonderful journey of over 5,800 miles, by far the longest possible fresh-water journey in the world.

Standing upon the bank of either fork of Atlantic Creek, just above the place of the "parting of the waters," we tossed chips, two at a time, into the stream. Though the two chips would strike the water within an inch or so of each other, not infrequently one would be carried by the current to the left, keeping in Atlantic Creek, while the other might be carried a little to the right and enter the branch running across the meadow to Pacific Creek; the one beginning a journey which will finally bring it to the Gulf of Mexico, the other entering upon a long voyage, in the opposite direction, to the Pacific. Where Pacific Creek leaves the pass it is about 6 feet wide and will average 2 or 3 inches deep, though it is much deeper in many places—in some places forming pools 1 to 2 feet deep. Just inside the pass, from *a* to *b*, the current flowed 268 feet at the rate of 1½ feet per second. The two forks of Atlantic Creek come together near the east margin of the pass and form a stream much like Pacific

Creek in size and general features. There are relatively deep pools in each of these forks, particularly in the lower parts.

We seined all of these creeks quite carefully and found plenty of small trout everywhere on each side. We took specimens in each arm of each of the Y's of Atlantic Creek and in such places as would have easily permitted them to pass from one side to the other, and there is no doubt whatever that trout can and do pass over this divide at will.

As is well known, Yellowstone Lake is abundantly supplied with trout, while Shoshone and Lewis lakes, two very similar bodies of water, were wholly without any fish life. The absence of fish from Shoshone and Lewis lakes is readily explained by the presence of vertical falls in Lewis River. But the much greater falls in the Lower Yellowstone River would certainly prove as effective a barrier in preventing fish from ascending to Yellowstone Lake from the Missouri. Evidently, Yellowstone Lake and the Upper Yellowstone River were stocked from the west, and almost certainly via Two-Ocean Pass. The probability that the outlet of Yellowstone Lake at one time was toward the Pacific, as claimed by geologists, only strengthens this solution of the problem. But while this explains the origin of the trout of Yellowstone Lake, it leaves another equally interesting problem without any explanation, viz, the presence of the blob (*Cottus bairdi punctulatus*) in Pacific Creek and its absence from Atlantic Creek and the entire basin of Yellowstone Lake.

We caught four blobs in Pacific Creek in the pass, but though we seined carefully in Atlantic Creek, only a few yards away, we did not find a single blob; nor were we able to find any further down Atlantic Creek or in any of the streams tributary to Yellowstone Lake. This fish could surely get across just as easily as the trout, and the four we caught would have had to travel upstream but a few rods through a channel filled with an abundance of water in order to be on the Atlantic side.

The water of Atlantic Creek and the Upper Yellowstone River does not seem to differ in any way from that of Pacific Creek, and the conditions there seem just as favorable to blobs. At present I am wholly unable to account for their absence; the matter needs further investigation.

During the night that we camped in Two-Ocean Pass (August 17-18), ice froze half an inch thick in a basin at our camp, and nearly as thick on the creek near by. The temperature of the air at 6:30 a. m. was 33°; of the water at 8 a. m., 42°; at 11 a. m., 55°. According to the U. S. Geological Survey, the elevation of Two-Ocean Pass above sea level is about 8,200 feet.

The "Lake sheet" of the map of the Yellowstone National Park by the U. S. Geological Survey includes Two-Ocean Pass, but it needs changing in some particulars. All of the line representing Pacific Creek *above* the pass should represent the South Fork of Atlantic Creek, and should be connected with the North Fork at the east edge of the pass; and Pacific Creek should be made to come into the pass from the northwest. (See diagram, Fig. 3, Pl. II.)

MISSOURI RIVER BASIN.

Atlantic Creek.—On August 18 we followed Atlantic Creek down to where it flows into the Upper Yellowstone River. We seined it about a mile above its mouth and found a few young trout. At this point the creek is about 36 feet wide, ¾ foot deep, and has a 3-foot current. The temperature of the water at noon was 57°. Less than 2 miles below the pass the trail crosses Jay Creek, a few rods above where it joins Atlantic Creek. At the ford, Jay Creek was 20 feet wide, 8 inches deep, and had a current of 2½ feet per second. The water at 10:30 a. m. was 47°. About 2 miles further down, we crossed Senecio Creek about one-fourth of a mile above its mouth. This is a stream much like Jay Creek, but considerably smaller.

The Upper Yellowstone River.—We came upon the Upper Yellowstone at a point about 20 miles in a direct line above the lake, or 2 miles above Bridger Lake. Crossing it at this point, we traveled down the right bank to its mouth. This river is of good size and flows through a broad valley of meadow land which, in many places, has marshes bordering the river.

According to Mr. Arnold Hague, the Upper Yellowstone River "rises in an immense snow field on the north side of an isolated peak, about 25 miles south of the southern boundary of the Park. The peak attains an elevation of over 12,250 feet above sea level, and has been long recognized as a prominent point by all topographical survey parties. Although never visited, it has been designated as Younts Peak, after a trapper who lived for a long time along the banks of the Yellowstone. Three rivers—the Yellowstone, Gray Bull, and Buffalo Fork of Snake River—find their sources upon the abrupt slopes of this peak. To the southward and not far distant rises the Wind River. The region is an uncommonly rough one, with profound gorges penetrating far into the mountains and separated from each other by mere knife-edges of rock. The entire country is made up of volcanic material, for the most part andesitic breccia."*

We saw a great many young trout where we forded the river, and again near the mouth, where large fish were also abundant. A little time devoted to fly fishing here resulted in the capture of six very fine trout, 14 to 18 inches long, every one of which, however, was infested with the parasitic worm *Dibothrium cordiceps*. The temperature of the river near its mouth at 3:30 p. m. was 57°; air, 68°. Throughout most of its course the Upper Yellowstone River has a clean, gravelly bottom and flows with a good, strong current.

Bridger Lake lies just outside the original Park boundary and between the Yellowstone River and Thoroughfare Creek. This is a pretty little lake, about a mile long by half a mile wide, and is well filled with trout.

Thoroughfare Creek.—This is the largest tributary of the Upper Yellowstone River. At our camp, just at the Park line, it is fully 100 feet wide, 2 feet deep, and flows 3 feet per second. Temperature of water at 5 p. m., August 18, 60°; at 7:30 a. m., the next day, 45°; temperature of air at 6:30 a. m., 31°. We seined this stream very thoroughly, but found nothing except numerous very young trout. A good deal of fly fishing did not result in a single catch. The water is clear and pure and full of fish food of various kinds.

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* Hague, in Powell's Ninth Annual Report, page 93.

On the way down to the lake we crossed numerous small creeks, Escarpment, Cliff Mountain, and Trapper. The largest of these is Mountain Creek, it being 18 feet wide and a foot deep. These are all clear, cold streams, coming down from the heavily timbered mountains to the east, and all were found full of young trout.

Beaverdam Creek.—This stream flows into the lake just to the right of the mouth of the Upper Yellowstone River. Near its mouth, where we crossed, it is 20 feet wide, about 18 inches deep, and with a pretty swift current. Temperature of water at 10:30 a. m., August 20, 50°. The bed of the stream is very rocky, and there is little or no vegetation in the water. Fish food seemed scarce and no fish were observed, though we made several hauls with the seine. Near the mouth of this creek are several old beaver dams, from which doubtless the stream received its name.

From here our path led us down the east shore of Yellowstone Lake to the outlet. This is one of the most heavily timbered districts in the United States. The trees are of good size and so close together that it is no easy matter to find one's way along the game trails—the only trails found here. The lake is in sight most all the way and the views are very beautiful. (See Pl. VII.) We crossed Columbine Creek, a small stream of mineral water containing no fish, and camped at the mouth of Meadow Creek, another very small, sluggish stream, but full of young trout. In places this creek was 12 feet wide, a foot or more deep, and had a somewhat muddy bottom These were really pools, with scarcely any current. In other places the stream was not so wide nor deep, but swift and rocky. Temperature of water at 3 p. m., August 20, 57°; at 8:30 next morning, air, 57°; water, 51°. Young trout were very abundant in this little creek.

Pelican Creek.—This is a fair-sized stream, flowing into Yellowstone Lake near the outlet. Near its mouth it is about 35 feet wide, 1½ feet deep, and flows with a moderately swift current. The temperature at the mouth at 6 p. m. August 21 was 52°. Along this stream are numerous springs, many of them of mineral water. The stream is full of young trout. From here we traveled down the Yellowstone River to the ford, where we crossed to the left bank, and then followed the Government road to the Mammoth Hot Springs Hotel.

Yellowstone Lake and the streams below it have already been well described by Dr. Jordan in his report on the Yellowstone National Park. (Bulletin IX, U. S. Fish Commission, pp. 41–63, 1891.) The following from Mr. Hague, Powell's Ninth Report, pp. 92 and 93, concerning Yellowstone Lake, should be added:

> In comparison with its size the drainage area is small. This is readily accounted for by its great altitude above sea level and the very favorable conditions of the surrounding country for receiving a heavy snowfall throughout eight months of the year. Over a great part of this area these snows are protected by the forests from the dry westerly winds, and the water is allowed to percolate the soil gradually, supplying the springs and streams which feed the lake. The altitude of Yellowstone Lake is 7,740 feet above sea level, with a surface area of 139 square miles and an indented shore line of nearly 100 miles. As yet we possess but little accurate knowledge of its depth, although there is no question that it presents the grandest natural storehouse for water within what is known as the arid region of the West. If the broad valley of the Yellowstone for 200 miles is ever to be settled with a prosperous people, this body of water will be of inestimable value for the purposes of irrigation. From careful measurements made of the flow of the Yellowstone River just below the outlet of the lake, the discharge of water was found to be 1,525 cubic feet per second, or about 34,000,000 imperial gallons per hour. The gauging of the stream took place in September, when the lake stood at a lower level than at any other period of the year.

In 1889 the Irrigation Survey measured the Yellowstone River at Horr and Springdale, just north of the Park, and obtained results remarkably close to those obtained by Mr. Hague. Capt. Dutton says:

> The Yellowstone in August carried at Horr 1,553 second-feet on the 26th of August, and at Springdale 2,111 second-feet, which is about as low as it may be expected to fall in any season.*

We examined the Yellowstone River pretty carefully between the lake and the falls, for the purpose of determining if any of the whitefish planted there in 1889 by Mr. Lucas could be found. Not one was seen, and it is not believed any have survived. Careful inquiry among members of Mr. Wyatt's road camp failed to elicit any evidence of the presence of whitefish. This party had been encamped upon the bank of the river for some time and had had excellent opportunities for observing the whitefish, if any were there. Trout, both large and small, were very abundant in the river here. They are eaten quite freely and are not regarded as being seriously affected by the parasitic worm. Many of the trout taken here are said not to be affected at all.

Blacktail Deer Creek was examined at the crossing of the Cooke City road, and Lava Creek or East Fork of Gardiner River was examined between the two falls, where one small trout was taken with the hook. Whether this was one of the plant made here by Mr. Lucas in 1889 can not be certainly known, as it is reasonably certain that trout were found naturally in this creek, as explained by Dr. Jordan in his report.

Red Rock River.—This river was examined by Mr. Clapham 3 miles north of Red Rock Station on the Union Pacific Railroad. It rises in Red Rock Lake, about 40 miles distant, in the mountains on the Idaho line. Near Red Rock it is a good-sized stream, about 30 feet wide and 20 inches deep. It is full of deep holes and eddies. The bottom is usually quite rocky, but there are stretches of sand and mud. The water is clear, but not very cold, the temperature being 58°. This is a very good fish stream, blobs, dace, suckers, grayling, and whitefish being abundant, and one specimen of the ling (*Lota lota maculosa*) was taken. No trout were found here, though higher up the stream and in Red Rock Lake trout are said to be abundant. The ling is also said to be common in Red Rock Lake.

Beaverhead River.—This is simply a continuation of Red Rock River, the name changing at Grayling Station. We examined this river at a point 2 miles above Dillon, Montana, and from there downstream to below the town. It is there a rather large stream, 50 feet wide and at least 2 feet in average depth. It flows through Dillon Valley, which is several miles broad. It has mud or adobe banks, usually covered with a rank growth of willows and other bushes. The bottom is usually one of gravel, but there are muddy places here and there where the current is less swift and where the stream is filled with *Ranunculus* and many species of *Algæ*. Along its banks are many ponds filled with water vegetation. The temperature of the water at noon, July 27, was 63°. This is apparently too warm for trout, as none were seen, and we were told that none are found this far down the stream. It is, however, an excellent stream for whitefish and grayling, with which species it is well supplied. Suckers, dace, and blobs were also abundant, the blobs being exceptionally large. Black bass would certainly do well in such a stream as this.

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*Powell's Tenth Annual Report, Part II, p. 89.

Beaverhead River flows in a general northeasterly direction, and joins the Bighole River east of Melrose to form the Jefferson River. The Bighole River is much the same kind of a stream as the Beaverhead. It is said to be well filled with whitefish and suckers.

Our route from the Mammoth Hot Springs to Shoshone Lake was essentially the same as that followed by Dr. Jordan's party in October, 1889. The waters of this region were fully described by him, and but little need be added in this report concerning them. A few observations were made, however, that should be recorded. The temperature of Glen Creek at 11 a. m., August 25, was 54°. The temperature of Indian Creek at 11:30 a. m., August 25, was 52°, while on August 7, when the air was 70°, the water was 55°.

The brook trout that were placed in these streams in 1889 are evidently thriving well, as we found not only individuals of that plant, but young that could not be over a year old. In Cañon Creek we found an abundance of blobs, but did not succeed in taking any trout, although specimens were collected there by Dr. Jordan.

A plant of 9,800 Von Behr trout was made in Nez Percé Creek in 1890. Though we were, at the time of our visit, unable to find any fish, we were informed by Lieut. Pitcher that fish have been seen there this season; and Mr. Elwood Hofer writes me that, on October 9 of this year, he saw trout in Nez Percé Creek near the "Soldiers' Camp." These are most probably of the plant of 1890, as this creek was believed to be wholly barren of fish until the time of this plant. Mr. Hofer, however, believes that the native black-spotted trout is found in Nez Percé Creek, but can not see how they got there.

The *Firehole* was examined at various places. This stream contained no fish above Keppler Cascade until 1889, when a plant of Loch Leven trout was made here by the U. S. Fish Commission. Specimens of this trout were seen above the cascade, and one was obtained in the river above Old Faithful Geyser. At the mouth of Firehole River grayling, whitefish, dace, blobs, and suckers were found in abundance.

Gibbon River was examined at various points from above Virginia Cascade to its mouth, where it joins the Firehole to form the Madison. This stream was stocked with rainbow trout in 1889, and we found specimens both above and below Virginia Cascade. At the mouth of Gibbon River we found all the species that were found in the Firehole near by. These two streams unite about 6 miles below Gibbon Falls, and about the same distance below the Lower Geyser Basin.

Madison River.—On August 23, 24, and 25, I made a trip from Norris Basin down the Madison River to Horsethief Springs, beyond the western boundary of the Park. The road to this place passes down the Gibbon River, which it crosses near its mouth, and then follows the Madison River very closely for several miles, crossing it no less than five times before reaching Horsethief Springs. The upper course of the Madison River is through a narrow and very picturesque cañon which widens out below into a broad, grassy valley. The banks and bed of the stream are rocky or of coarse gravel. The water is clear and sparkling, but not cold—this latter fact being due, of course, to the great amount of hot water which is poured into it from the Upper and Lower Geyser Basins. The current is in most places quite swift, and the stream is well filled with *Chara*, *Algæ*, and various other kinds of water vegetation. This is evidently an excellent fish stream, at least as far up as the forks—grayling and whitefish being really abundant; dace, blobs, and suckers were all common.

Horsethief Springs are described in detail in another part of this report, and the description need not be repeated here. Suffice to say that there is probably no place in Montana where grayling, whitefish, and mountain trout are more abundant.

Mr. E. R. Lucas, in a note to Dr. Jordan, says:

> On October 2 [1889], I collected from Horsethief Springs 2,000 whitefish, which I planted the next day in Twin Lakes. * * * On October 15 I collected 1,000 more whitefish and planted them in Yellowstone River above the falls. There are unlimited numbers of these whitefish in Horsethief Springs, running in size from 2 to 5 inches. There are also quite a large number of grayling in the stream.

Mr. R. R. Cummins, the owner of the springs, in a letter to me dated December 20, 1891, says:

> The grayling and trout are just swarming in the stream. I caught eighty-two grayling weighing from one-half pound to 2 pounds 2 ounces in about five hours' fishing, using grubs for bait.

My own observations, made August 24, convinced me of the abundance of these species here. Every nook and corner and especially every deep pool was found to be full of fish, most of them young, but some of good size. The whitefish and grayling seem to exceed the trout in numbers. These three species not only find an abundance of suitable food here, but also use this as a spawning ground. The blob is also very common here.

Bozeman Creek.—This is one of a great number of interesting streams flowing through the rich agricultural Gallatin Valley. It flows northward from Sour Dough Cañon, through the town of Bozeman, and, with Middle Creek, forms the East Gallatin River about 10 miles northwest of Bozeman. This latter stream flows into the main Gallatin River at Barton's Bridge, about a dozen miles farther northwest, or about 10 miles east of where the Gallatin, Madison, and Jefferson Rivers unite to form the great Missouri. Bozeman Creek at the bridge in the edge of the town is perhaps 30 feet wide and will average 18 inches deep. The banks are covered with bushes and the bed of the stream is of coarse gravel. The water is pure and clear. The temperature at 9:30 a. m., August 27, was 61°.

Bridger Creek is a somewhat smaller stream, but is otherwise very much like Bozeman Creek, into which it flows. At Davies Springs this creek was 10 feet wide, 10 inches deep, and had a current of 2 feet per second. The temperature of the water at noon was 60° opposite the springs, while a little higher up it was but 56°. This difference is no doubt due to the fact that a warm spring pours its water into the creek just opposite Davies Springs. Just above these springs is a very interesting cañon, through which the creek flows.

Both of these creeks are very good fish streams, and are said to be well filled with trout and grayling.

Dr. F. V. Hayden says:

> The drainage of the Gallatin is composed of a large number of little streams that rise in the Great Divide for a distance of 80 to 100 miles, and each of these little streams gashes out a deep gorge or cañon in the mountain sides. * * * The valley of the Gallatin, like the valleys of all the streams in Montana, is undoubtedly one of erosion originally, and was also the bed of a lake. This lake basin extended down to the junction of the Three Forks northward, and the modern deposits are found all along the base of the mountains on either side of the valley up to the very sources of the river, sometimes rising quite high on their sides. So great has been the removal of sediment, during and since the recession of the waters of the lake, that it is not always easy to determine the entire thick-

ness of the original deposit. Remnants are left, however, at different points, sometimes in the higher ranges of foothills, or in patches among the metamorphic rocks at considerable elevation on the divides between the Gallatin, Madison, and Jefferson forks. Areas of greater or less extent occur 600 to 800 feet above the channels of the rivers, showing that the waters must have been so high that only the more elevated summits were above the surface.

McClellan Creek rises among the hills on the "Crow Divide," flows northward about 15 miles, and empties into Prickly Pear Creek about 5 miles southeast of Helena. We examined this stream for some distance along its course, 12 miles east of Helena, near an old Spanish quartz mill or *arastra*. This creek is said to be usually a clear stream, but at the time of our visit the water was somewhat muddied by recent rains and by some placer mining going on in this vicinity. The banks and bed of the stream are very rocky and the current very swift. The stream is 8 to 15 feet wide and averaged perhaps 2 feet deep. The temperature of the water at 10 a. m., July 20, was 47.5°; air, 70°. Owing to the extreme swiftness of the current the use of the seine was made very difficult. Numerous hauls resulted in the taking of five trout, each 8 to 10 inches long. Some of these were full of eggs, showing this to be near the spawning season. No other life was noticed in the stream. A few frogs and snakes were seen along the banks.

Prickly Pear Creek, into which McClellan Creek flows, is a much larger stream, but nearly all of its water is used for irrigation purposes. It flows through the beautiful Prickly Pear Valley and empties into the Missouri north of Helena Junction. This was at one time an excellent trout stream, and a few trout are still found in its upper portion.

PLACES EXAMINED WITH REFERENCE TO THE LOCATION OF A STATION.

In general, it may be said that every stream and place visited by us was examined with reference to its furnishing the necessary natural conditions of such a fish-cultural station as is desired for that region. In another part of this report will be found a discussion of the general physical features of western Montana and northwestern Wyoming, including a somewhat full description of each particular lake, stream, or spring examined; this will show that there are several places, any one of which can furnish perhaps all the required natural conditions. It is proper to state here that it was not possible, within the time at our disposal, to visit all parts of Montana and Wyoming and examine all the localities that might supply suitable sites for a fish-cultural station. Nor was it necessary that every place should be visited, for among those that we were able to examine is found an ample number from which to make the selection.

The following is a list of the places where we made special examination with reference to the hatchery question: McClellan Creek and Child's ranch, near Helena; Little Blackfoot River, at Elliston; Cottonwood Creek, at Deer Lodge; Rattlesnake and Lolo creeks, near Missoula; Swan River, at Swan Lake; Glen Creek and Gardiner River, near Mammoth Hot Springs; Reese Creek, near Horr; Horsethief Springs, Montana; Botteler Springs, south of Livingston; and Davies and Wolverton springs, near Bozeman.

McClellan Creek rises in the hills on the Crow Divide, flows northward about 15 miles, and empties into the Prickly Pear Creek about 1½ miles south of East Helena. We examined the stream up and down for more than a mile, 12 miles east of Helena, this being in the vicinity of the old Spanish arastra or quartz mill. Here it is a stream 8 to 15 feet wide and averaging 20 to 24 inches deep. It has a very swift current, the flow being not less than 3,300 gallons per minute. It is usually a clear stream, but at the time of our visit it was rather muddy, due to a heavy rain on the preceding day. Several mining ditches are taken out at various places both above and below where we saw the stream, and there is, of course, some danger of contamination from this source. The bed of the stream is very rocky, as are also the banks and much of the country through which the stream flows. The banks are in many places covered by a dense growth of alders and other small trees and bushes. The temperature of the water at 10 a. m., July 20, was 47.5°; air, 70°.

Owing to the rough character of the bed and the swiftness of the current, it was very difficult to use the seine to any advantage. Quite a number of attempts to haul the seine were made, however, resulting in the taking of but five small trout, from 8 to 10 inches long. Two of these were females, in one of which the eggs were quite ripe, showing that this was near the spawning season of the species in this locality. No other kind of life was noticed in this creek.

Child's bedrock drain is on the land of Hon. C. W. Child, about 2 miles from East Helena, or 6 miles east of Helena. Mr. Child has put in this drain for irrigation purposes. The water is collected by means of transverse ditches in the glacial drift resting upon the bed rock near Prickly Pear Creek. The water thus collected is carried in a box flume for some little distance and is then turned into an irrigating ditch where it goes to augment the supply in a ditch from McClellan Creek. The stream flowing from this drain was 20 inches wide, 10 inches deep, and had a current of 17 inches per second, which means a flow of 883 gallons per minute. The water is of course very clear and pure and exceedingly cold. The temperature at 11 a. m., August 5, was 42°; air, 75°. This is the coldest water that we found anywhere in Montana or Wyoming, and its temperature is no doubt constant or nearly so the year round. According to Mr. Child, the quantity of the flow is approximately constant. The nature of the source of supply, of course, makes these facts evident. The water is perfectly clear and free from solid matter, and would seem to be well suited for trout-cultural purposes, unless, indeed, it be somewhat too cold. A rather level tract of several acres lies below the drain about three-fourths of a mile, where suitable grounds for the building and ponds can be had. The ground is somewhat rocky, being covered with coarse morainic material, and the cost of clearing it off and constructing the ponds would be considerable. Sufficient fall from the drain to this place can be had to give a good gravity supply.

Both the Northern Pacific and the Montana Central railroads run within less than a mile of the place where the station would be located. By additional work the amount of water could be doubled, which would make an abundant supply for the purposes required. Mr. Child would make all the guarantees as to water control that the Commission would desire. No definite proposition has been made by Mr. Child as to what the necessary land would cost the Commission. The cost of getting the water in sufficient quantity under control and the expense that would be necessary in the construction of the ponds are serious objections.

Little Blackfoot River was examined July 21, near Elliston. It was at that time about 25 feet wide, 2½ feet deep, and had a current of 3 feet per second, this giving a flow of 84,375 gallons per minute. Above Elliston the water is clear and pure, but below that place the stream is muddied by mining operations carried on along its banks. The current is very swift, the bed of the stream is strewn with rocks of various sizes, and the banks are well lined with willows, cottonwoods, and various other small bushes. The temperature of the water at 4 p. m. was 55°; air, 71°. In this river we found an abundance of blobs and young whitefish, and a few small trout. In a small creek flowing into the river, suckers and minnows (*Catostomus catostomus* and *Rhinichthys dulcis*) were abundant. The high temperature of the water and the danger of contamination from heavy rains are serious objections.

Cottonwood Creek.—We examined this stream from its mouth at Deer Lodge upstream for about 3½ miles. At a point about 2 miles above the town of Deer Lodge and on the land of Mr. Albee, we found the most suitable location. The stream here measured as follows: Average width, 20 feet. Average depth, 1½ feet. Current, 3 feet per second. Volume, 40,394 gallons per minute. Temperature, 54° at 3 p. m., July 22; air, 77°.

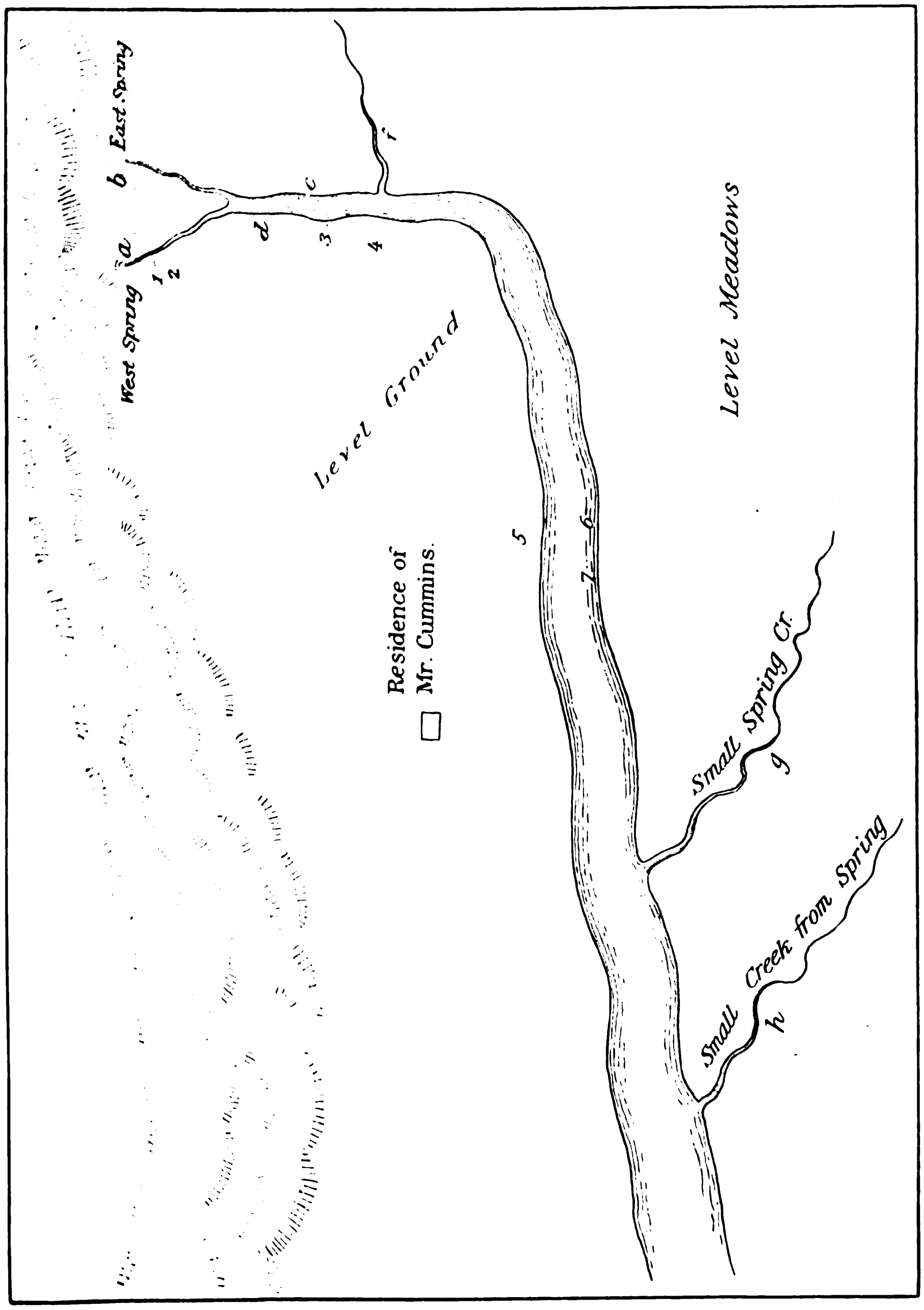
This is a clear stream flowing through gorges farther up, while here it flows through rather rough meadow land. The bed of the stream is very rocky; the banks are lined with cottonwoods, alders, and other bushes. The stream seems to be well filled with insect larvæ and other fish food, and is regarded as being an excellent trout stream. During less than two hours' fishing with seine and fly, we took a great many blobs and about thirty trout, the largest weighing about 7 ounces. The fall is sufficient for getting the water properly and easily into the hatchery, and very desirable ground can be had either near the residence of Mr. Albee or on the ranch of Mr. N. J. Bielenberg, a few rods farther up the stream. The cost of getting the water under control and of constructing the ponds would be very moderate. At the time of our visit a little mining was going on above Mr. Albee's; this contaminated the water somewhat, but Mr. N. J. Bielenberg assures us that this can be easily controlled. The town of Deer Lodge gets its water from this stream, and of course would interest itself in seeing that the stream is never seriously contaminated.

Mr. Bielenberg offers to donate as much land as would be needed and to make all necessary guarantees as to the water supply. The location with reference to the region to be stocked is a central one and the railroad facilities are good. The city of Deer Lodge is one of the prettiest, most thriving cities in the State, and would afford excellent school, church, and social advantages to all connected with the station, matters of no little importance.

Rattlesnake Creek.—This is a good-sized stream flowing into the Missoula River, at Missoula. We examined it throughout the last 8 miles of its course; average width, 30 feet; average depth, 1⅔ feet; current, 2½ feet per second; volume, 56,250 gallons per minute; temperature, 54° at 3 p. m., July 28. This stream rises in two small lakes in the mountains north of Missoula, is about 20 miles long, and flows through Government land, except for the last 2 miles of its course. The rock of the region seems to be chiefly a metamorphic sandstone; the bed of the stream is full of bowlders of various sizes, and there is but little water vegetation. The water is pure, clear, and cold. The city of Missoula gets its water from this stream, the ditch being taken out less than 2 miles above the city.

There are many places within a distance of 2 to 6 miles of the city where very suitable land can be found. The fall is sufficient and the land lies so as to make it a comparatively easy matter to get the necessary amount of water under control.

PLATE III.



HORSETHIEF SPRINGS, MONTANA.

Missoula is situated upon the Northern Pacific Railroad, in the western part of the State, a location hardly sufficiently central as regards the region to be supplied. I have no information as to what would be the cost of sufficient land in this locality. Hon. W. M. Bickford, of Missoula, would furnish any information of this kind that might be desired.

Lolo Creek is a very pretty mountain stream having its rise on the Divide, near the Idaho line. It flows eastward for about 40 miles and empties into the Bitter Root River about 12 miles southwest of Missoula. We examined this stream through the last mile of its course but one. It is here about 35 feet wide, with an average depth of 2½ feet, and with a rather swift current. It flows over a gravelly bottom and between gravelly banks, which are covered by a heavy growth of alders, willows, and cottonwoods. The stream here is often divided up and runs in several channels with low-lying islands in between, which are covered with a heavy growth of bushes and small timber. There are also many small bayous or marshy places along this lower portion of the stream which are filled with a species of *Ranunculus* (*R. aquatilis trichophyllus*). Trout, blobs, suckers, and minnows were common. The temperature of this stream at noon July 30, was 56°.

Depew Creek is a small stream, about 8 miles long, which flows into Swan River from the right, just below the foot of Swan Lake. Its entire course is on Government land and through dense pine forests. It runs between 1,000 and 2,000 gallons per minute. The water is clear and pure and has a temperature of less than 50°. At 11 a. m., August 3, its temperature at its outlet was 48°. The amount of water is said not to vary much. It never becomes contaminated on account of rains, and there is no probability of its ever being injured in any way through mining operations. The fall is great enough to enable the water to be gotten under control very easily. All the natural advantages requisite for the establishment of a hatchery can be found at the mouth of this creek. Its nearness to Swan River and the large and interesting lakes which that river connects would prove a great advantage in many ways. The remoteness of the location from a railroad is a serious objection.

Horsethief Springs.—These springs are on the ranch of Mr. R. R. Cummins, in Gallatin County, Montana, about 4 miles from the west line of the Yellowstone National Park, and near its northwest corner. There are two of them coming out on the south slope of a small grassy mountain near its base, and soon uniting to form one stream, which flows into the North Fork of the Madison River. The accompanying diagram (Pl. III) will help to an understanding of these springs:

Distance between springs (*a* to *b*)	feet	135
Width of west spring at *1*	inches	40
Depth of west spring at *1*	inches	4
Current between *1* and *2* (35 feet)	feet per second	3¼
Volume of west spring	gallons per minute	1,745
Width of main stream at *3*	feet	35
Depth of main stream at *3*	inches	5
Current from *3* to *4* (51 feet)	feet per second	4
Volume of main stream at *4*	gallons per minute	26,181
Width of stream at *5*	feet	70
Depth of stream at *5*	inches	10

Current between *6* and *7* (50 feet), a trifle over 1 foot per second.

Volume at *7*, about 26,181 gallons per minute.

Temperatures were taken in the morning of August 24, between 8 and 10 o'clock, when the air was about 70°:

	Degree.		Degree.
Temperature of water at *a*, at 8 a. m.	48	Temperature three-fourths mile below *e*, at 9:40 a.m	49
Temperature at *b*, at 8 a. m	45.5	Temperature of small stream *f*	46.5
Temperature at *c*, at 8:15 a. m	46	Temperature of small stream *g*	44
Temperature at *d*, at 8:35 a. m	48	Temperature of small stream *h*	46
Temperature at *e*, at 9 a. m	48		

The stream, formed by the uniting of the waters from the two springs, flows south about 300 feet, then turns west and flows in that general direction for at least one-fourth mile, where it receives the small branch *h* from the left, and continues about 1 mile further before joining the Madison. The current within the first 180 feet from the springs is very swift, the fall being at least 20 feet. Below that the fall is very slight, the current in no part of this portion being much greater than 1 foot per second. Just north of the springs and west of them the ground rises rapidly; to the east there is also a slight rise, but to the south and southwest is very attractive meadow land with just sufficient slope to render the construction of ponds upon it a very easy matter. Indeed, the stream itself could be easily converted into ponds simply by damming, thus cutting it up into suitable sections, any one of which could be drained into the one below. The water is pure, clear, and cold, and certainly well suited in every way for trout. The bed of the stream is gravelly. There is an abundance of *Algæ*, *Chara*, and other water vegetation in the stream. Small mollusks and insect larvæ abound, and trout, grayling, and whitefish are exceedingly abundant. In fact, the grayling and trout use this stream and the small branches coming into it as a spawning ground, vast numbers of these two species and many whitefish being found here during the breeding season. This is, of course, conclusive evidence as to the excellent character of these waters as breeding grounds for members of the *Salmonidæ*.

The water in these springs never freezes, and Mr. Cummins informs me that it does not freeze in the creek at any point within a mile of the springs.

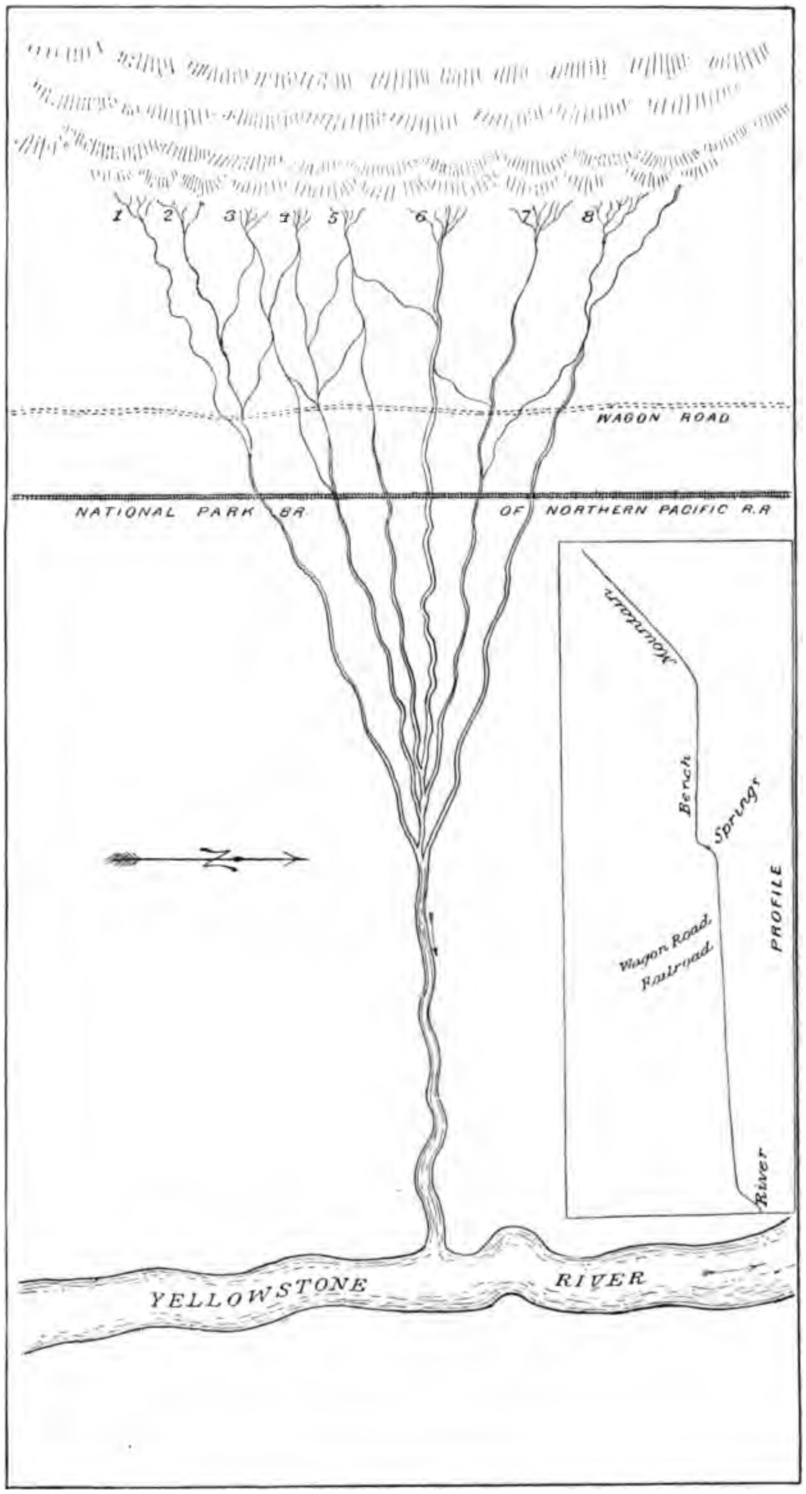
Mr. Cummins, who owns the springs and the lands through which the creek flows, will donate to the Commission all the ground that may be needed.

At present, the nearest railroad station to these springs is at Cinnabar, Montana, about 70 miles northeast. They are 125 miles south of Bozeman. The Northern Pacific Railroad has recently surveyed a line from Gallatin, Montana, to the north line of the Yellowstone Park, running within 1½ miles of the springs. The Union Pacific Railroad has two lines surveyed through this region, each of them running very close to these springs; one of the lines proposed by the Union Pacific is from Gallatin, the other from Beaver Cañon. Each runs to the Park line near Mammoth Hot Springs.

The natural advantages offered by Horsethief Springs are, in my judgment, superior to those found at any other place visited by us. The water is excellent in character and enormous in quantity. The topography could scarcely be improved. The location is central with reference to the region to be stocked—in short, *all* the *natural* conditions are most favorable. Should the Northern Pacific or the Union Pacific build a branch road to the Park over the line surveyed, I do not think a better location for the station could be found than at Horsethief Springs.

Glen Creek was examined just above the Golden Gate in the Yellowstone National Park. It is there a small stream about 5 feet wide, 6 inches deep, and with a current of about 18 inches per second. This gives it a flow of about 1,683 gallons per minute.

Bull. U. S. F. C. 1891. Fish-cultural Investigations in Montana and Wyoming. (To face page 39) **PLATE IV.**



BOTTELER SPRINGS.

The temperature of the water at 10 a. m., August 25, was 50°. The water is clear and of good quality, but probably becomes muddy during heavy rains. This stream was examined again near where it flows into the Gardiner River, and this latter stream was also examined. The banks of both are quite high and the adjacent land entirely too rough and rocky for the purposes contemplated.

Reese Creek is a small stream flowing into the Gardiner River near Horr, Montana, a few miles north of Cinnabar. We examined it through a mile or more of its course just above the railroad. Most of its water is taken out for irrigation purposes, but above all these ditches we found it to be about 5½ feet wide, 7 inches deep, and to flow with a current of 2½ feet per second, which gives it a volume of 3,600 gallons per minute. The temperature of the water at noon, August 26, was 48°. About 1½ miles above the railroad is a very suitable tract of land which could probably be had if desired. This is above where the irrigation ditches are taken out, therefore the water needed for the station could be turned back into the stream and thus not interfere with any previous water rights. It is quite probable, however, that this stream becomes more or less muddy during heavy rains.

Botteler Springs.—These springs are on the west side of the Yellowstone Valley about 3 miles south of Fridley, Montana, just opposite Emigrant Peak, and on the National Park branch of the Northern Pacific Railroad. The distance to Cinnabar is about 25 miles, which is also about the distance to Livingston. There is a large number of these springs, some very small, just oozing from the ground, others issuing in strong streams. They all come out near the upper margin of a bench composed of morainic material, and are grouped in such a way as to unite into eight streams which cross the road in front of the bench within a short distance of each other. The springs of all the eight groups lie within a limit of 50 rods of each other, and the water from all could be easily gathered into one stream which would give a flow of at least 4,275 gallons per minute. This amount could be increased to probably 6,000 gallons per minute by gathering up the water from a number of small springs not taken into account in the above estimate. The bench is covered with trees, such as quaking asp, willows, rose bushes, and other small bushes. The immediate vicinity of the springs, though gravelly, is marshy. They are so situated that only the most northern group (No. 8) can receive any wash from the adjacent land during even heavy rains. Most of the springs are surrounded by a thick growth of bushes. Watercress and other plants are abundant in the streams made by the springs. Insect larvæ, young trout, frogs, etc., abound in the streams, and the Yellowstone River in the immediate vicinity has an abundance of trout, many individuals of very large size being noticed.

The ground in front of the bench is a plain with a gradual descent to Yellowstone River, three-fourths of a mile distant. The foot of the bench is 300 yards west of the railroad and 35 feet above it. The cultivated portion of the ranch which lies between the bench and the river is irrigated mainly by the water from a neighboring creek, the water from the springs being used only occasionally. The accompanying rough diagram (Pl. IV) will be helpful in understanding the position and nature of the springs.

These springs were inspected on August 26 and 27 by Prof. Jenkins and Mr. Clapham. The groups I have numbered from 1 to 8, beginning at the south. In determining the amount of water flowing from each group it was found that, owing to the marshy character of the ground and the ramifications and interlacings of the various little streams, only approximate results could be reached. It is believed, however, that the aggregate flow of these springs can not be less than 5,000 gallons.

The following table gives the approximate width, depth, current, and volume, together with the temperature of the water of each main spring:

Group.	Width in inches.	Depth in inches.	Current in inches per second.	Gallons per minute.	Temperature.
					°
1	8	2	48	200	50.75
2	8	2	36	149	....
3	12	3	36	336	50.50
4	Could not well measure.				
5	24	6	12	449	48.50
6	36	3	10	449	49.00
7	72	6	10	1,796	48.00
8	36	8	12	897	50.00
	Total flow over			4,275	

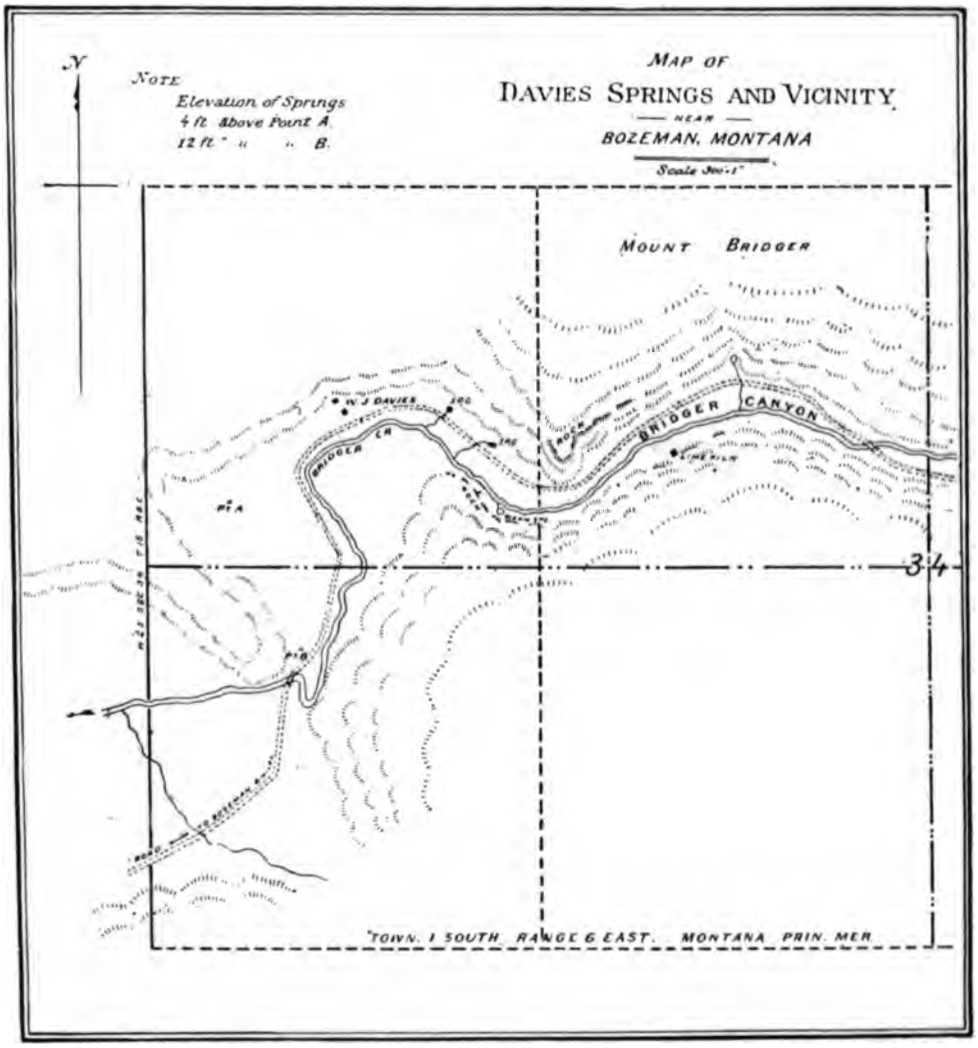
We were informed that the water in these springs never freezes, and that the volume and temperature remain approximately constant throughout the year.

This location seems to be an admirable one in every way, so far as natural conditions are concerned. Its nearness to the Yellowstone National Park, which is destined to become the great national game preserve, is a matter of no little importance. I have no doubt that satisfactory arrangements regarding the necessary land for the site can be made with Mr. Botteler, the owner.

Davies Springs.—These springs, two in number, are on the land of Mr. W. J. Davies, 4 miles from Bozeman. They come out at the roadside at the base of a limestone bluff. Two small streams are formed which flow across the wagon road and within a few yards enter Bridger Creek. The east spring, at 10 a. m. August 27, had a temperature of 46°. The stream flowing from it was about 10 feet wide and 4 inches deep, and flowed at least 1,496 gallons per minute. The west spring is a little warmer, its temperature being 47°. It flows a stream 3½ feet wide, 4 inches deep, and with a current which gives not less than 525 gallons per minute. The water from these two springs can be easily united into one stream which would give over 2,000 gallons per minute. Just across Bridger Creek is a good-sized spring of comparatively warm water, its temperature being 79°. Bridger Creek near the springs is about 10 feet wide, 10 inches deep, and has a current of 2 feet per second. Its temperature was 60°. The springs are surrounded by alders, rose bushes, willows, cottonwoods, and bushes of other kinds. There is an abundance of cress, moss, and other water vegetation in the springs and the streams running from them. Sufficient suitable ground could probably be had just below the springs, and it would no doubt be furnished to the Commission on satisfactory terms.

The accompanying plat (Pl. V) shows clearly the nature of the proposed site. The location is a central one with reference to the region to be stocked. Bozeman is on the Northern Pacific Railroad where the main line branches, one running to Helena, the other to Butte, both branches again uniting at Garrison. The Gallatin Valley, in which Bozeman is situated, is one of the most fertile and most attractive that we have ever seen. Bozeman is but 20 miles west of Livingston, where the branch road leaves the main line of the Northern Pacific for the National Park.

Wolverton Spring, 4 miles south of Bozeman, was also examined. This consists of one main spring and a great number of small ones coming out at various places in



DAVIES SPRINGS NEAR BOZEMAN.

a marshy tract of ground just below the main spring. The stream from the main spring was 2 feet wide and 10 inches deep, and flowed about 748 gallons per minute. Its temperature at 3:30 p. m., August 27, was 52°, or 48° in the spring itself, which was shaded. Measured at a point one-fourth mile below the springs, the stream was found to be 5 feet wide, 8 inches deep, and to have a current of 1 foot per second. This would indicate a flow of about 1,500 gallons per minute. The temperature here was 52° at 4 p. m. These springs all come out in a low marshy piece of ground and form a kind of pond filled with watercress and other water plants. The pond is surrounded by willows, cottonwoods, chokecherries, and other bushes. The stream flows across the road to the north from the marsh, and continues northward through a meadow for a mile or more. Its banks are covered with a dense growth of bushes. The ground over which it flows is perhaps too level to afford sufficient fall for a gravity supply.

ANNOTATED LIST OF FISHES OBTAINED IN MONTANA AND WYOMING.

As shown in the preceding pages of this report, the region over which our explorations extended is, in general, a mountainous one, most of whose streams are clear and cold, and flow with a rapid, often turbulent, current. The number of species of fishes in such waters is never great. Though our collection contains but 16 indigenous species, it no doubt represents fairly well the fish fauna of that region. The species represented, grouped by families, are the following:

Catostomidæ.
1. *Catostomus discobolus* Cope.
2. *Catostomus catostomus* (Forster).
3. *Catostomus macrochilus* Girard.
4. *Catostomus ardens* Jordan & Gilbert.

Cyprinidæ.
5. *Rhinichthys dulcis* (Girard).
6. *Mylocheilus caurinus* (Rich.).
7. *Ptychocheilus oregonensis* (Rich.).
8. *Leuciscus hydrophlox* (Cope).
9. *Leuciscus gilli*, sp. nov.
10. *Leuciscus atrarius* (Girard).

Salmonidæ.
11. *Coregonus williamsoni* Girard.

Salmonidæ—Continued.
12. *Thymallus signifer* (Rich.).
13. *Salmo mykiss* Walbaum.
14. *Salvelinus malma* (Walbaum).

Cottidæ.
15. *Cottus bairdi punctulatus* (Gill).

Gadidæ.
16. *Lota lota maculosa* (Le Sueur).

Salmonidæ (introduced into the Yellowstone National Park).
17. *Salmo irideus* Ayres.
18. *Salmo fario* Will.
19. *Salmo trutta levenensis* Walker.
20. *Salvelinus fontinalis* (Mitchill).

The most abundant, important, and generally distributed of these is, of course, the black-spotted or mountain trout, with its almost constant and destructive attendant, the blob. Just how destructive the blob is to the eggs of the trout I am unable to say, but it is probably a very serious pest during the spawning season.

1. Catostomus discobolus Cope. (Pl. XVIII.)

Catostomus discobolus Cope, Hayden's survey, 435, 1870.

Thirteen examples of this species were taken in Red Rock River near Red Rock, Montana, and an equal number from Beaverhead River at Dillon. These specimens are from very small size to 7 inches in length. Head, 5; depth, 5; eye, 5; snout, 2 to 2¼; interorbital width 2; mouth and lips large, cartilaginous sheath of each lip well developed; fontanelle a very narrow slit; origin of dorsal fin much nearer snout than caudal; scales very small and crowded anteriorly, about 93 in lateral line. D. 10, its height 1¼ in head, a little greater than length of its base; anal long, nearly equal to head; pectoral shorter, 1⅕ in head.

2. Catostomus catostomus (Forster).

Cyprinus catostomus Forster, Phil. Trans., 1773, 155.

The collection contains the following specimens, which I refer to this species:

a. Little Blackfoot River, Elliston, Montana	16
b. Browns Gulch Creek, Silver Bow, Montana	47
c. Lolo Creek, near Missoula, Montana	22
d. Jocko River, Ravalli, Montana	5

All are young specimens, none being over 8 inches in length. Head, 4¼ to 4½; depth, 5 to 5½; eye, 5 to 6; snout, 2⅕ to 2⅓.

There is a little variation in the papillæ, but there are never over four rows on the upper lip; in fact two to three rows is the almost constant number. Compared with specimens of *C. griseus* from the South Platte, at Denver, Colorado, the Montana specimens have the lips much smaller, the rows of papillæ fewer, and the jaws with much less distinct cartilaginous cutting edge.

I have also compared them with specimens of *Catostomus catostomus* from various places, and others labeled *C. longirostris*, and am not able to see any important differences. The type of *C. retropinnis* Jordan has very much larger lips than in any other specimens I have examined, and the scales are smaller. It is perhaps best to retain it as a distinct species for the present at least.

3. Catostomus macrochilus Girard. (Pl. XVIII.)

Catostomus macrochilus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 175.

This large sucker is very common in Post Creek, on Flathead Indian Reservation, and in Swan Lake. It is no doubt common in Flathead Lake and the streams of that region, but we obtained specimens only from Post Creek and Swan Lake, three from the former and seven small ones from the latter. Examples 16 inches long have the head 4, depth 5, and eye 6. Scales, 11 or 12–72 to 75–10 or 11, about 40 before dorsal. Dorsal long, of 14 or 15 rays; pectorals and anal long, the latter nearly equal to head; papillæ not very large.

4. Catostomus ardens Jordan & Gilbert. (Pl. XVIII.)

Catostomus ardens Jordan & Gilbert, Proc. U. S. Nat. Mus., 1880, 464. (Utah Lake.)

We found this sucker very abundant in the Snake River at President Camp, where numerous specimens were taken, from very small ones up to a foot in length. Very much larger individuals, presumably of this species, were seen in water too deep to seine. Specimens 7 to 12 inches long have the head 4 to 4¼, depth 4½ to 5, eye 5¼ to 6, and the snout 2¼ to 2½. Scales, 10–63–9, much crowded in front; origin of dorsal fin very slightly nearer snout than base of caudal. Papillæ on upper lip in about five rows, not evidently so many in younger specimens.

5. Rhinichthys dulcis (Girard). (Pl. XIX.)

Argyreus dulcis Girard, Proc. Acad. Nat. Sci. Phila. 1856, 185; P. R. R. Survey, X, 243, pl. LIV, figs. 5–8, 1858.

Rhinichthys dulcis, Jordan, Bull. U. S. Fish Com., IX, for 1889, 1891, 48.

This little minnow is pretty generally distributed throughout the region visited by us, numerous specimens being obtained at each of the following places:

	No. of specimens.
a. **Beaverhead River, Dillon, Montana**	115
b. **Red Rock River, near Red Rock, Montana**	5
c. **Junction of Firehole and Gibbon Rivers**	23
d. **Snake River at President Camp, Wyoming**	6
e. **Browns Gulch Creek, at Silver Bow, Montana**	3
f. **Big Blackfoot River, near Bonner, Montana**	4
g. **Little Blackfoot River, Elliston, Montana**	6

Those from Beaverhead River are the largest specimens seen, many being 3½ to 4 inches in length. It was also more abundant here apparently than elsewhere. The specimens from the junction of the Firehole and Gibbon are all very small. In many examples measured, the origin of the dorsal is a little nearer the nostril than base of caudal fin, but midway between base of caudal fin and tip of snout.

6. **Mylocheilus caurinus** (Rich.) Girard. (Pl. XIX.)

Cyprinus (Leuciscus) caurinus, Richardson, Fauna Bor. Am., III, 304, 1836.
Mylocheilus caurinus, Girard, Proc. Acad. Nat. Sci. Phila. 1856, 169.

Common in Flathead Lake and in Bitter Root River. Curiously enough, at Flathead Lake it is called "whitefish" and is served at the hotels as such, while the true whitefish, which is not uncommon in the lake, does not appear to have attracted the attention of the local fishermen. About a dozen specimens were examined, ranging from 8 to 11 inches in length.

Head, 4 to 4⅓; depth, 4¼ to 4⅔; eye, 4¾ to 5; snout, 3¼ to 3⅔; pectorals, 1½ to 1⅜ in head; ventrals, 1⅘; dorsal, 8, a little longer than pectorals, about 1⅓ in head; anal, 8, equal to ventrals.

Scales, 12–77–7; teeth, 1, 5–5, 1 in numerous examples studied; in fact, I do not find a single case in which there are two teeth in the lesser row.

Color in life, dark greenish above, extending down nearly to the lateral line, where there is a dark irregular band two scales wide. Below this is a reddish band two or three scales wide, extending the full length of the fish, while the dark band stops at the posterior edge of dorsal fin; below, white; top of head, greenish; cheeks and opercles paler, with fine punctulations of dark; corners of mouth with a reddish wash extending backward on cheeks; a little orange on opercles and at base of pectorals.

7. **Ptychocheilus oregonensis** (Rich.). (Pl. XIX.)

This voracious fish is very common in Flathead Lake, where it is currently known as "squawfish." We also found it common in Lolo Creek and in Bitter Root River, near Missoula.

Numerous individuals from 7 to 12 inches long were examined. Head, 3¾; depth, 4½; eye, 6; snout, 3; scales, 19–80–7; teeth, 2, 5–4, 1. Tip of snout to angle of mouth, 2⅔ in head. Dorsal, 10; anal, 8; the pectorals equal the anal but exceed the ventrals; the height of the dorsal fin is contained 1¾ times in the head, and is ¼ greater than its length.

Color in life, above nearly uniform muddy greenish, a few scattered scales showing silvery; growing gradually silvery on the sides, with a slight tinge of orange, and slightly dusted with dark, this extending about four scales below the lateral line; under parts white, pale greenish on caudal peduncle; cheeks silvery, with a few dark spots, opercles silvery with orange washing and a few dark spots; ventral fins yellow, pectorals a little less so, anal same as ventrals; dorsal and caudal darkish or muddy yellow; maxillaries and tip of lower jaw with fine dark punctulations.

Younger individuals are essentially the same in color, only that the fins and posterior parts of the body are not so yellow and in the youngest there is a dark blotch at base of caudal fin.

8. Leuciscus hydrophlox (Cope). (Pl. xx.)

This species was very abundant in Snake River at President Camp, Wyoming, where eighty-three specimens were obtained; also in the small creek at the head of Jackson Lake. The specimens are 3 inches or less in length. Dorsal rays 9 in numerous specimens counted; anal usually 12, 11 in some examples; base of fin 6½ in length of body; maxillary barely reaching orbit, lower jaw somewhat projecting; dark band on side continued forward over the opercle; lateral line less decurved than in Heart Lake specimens.

9. Leuciscus gilli, sp. nov. (Types No. 43953, U. S. Nat. Mus.) (Pl. xx.)

This species is based upon fourteen specimens, 3 to 4¼ inches long, taken in Browns Gulch Creek, at Silver Bow, Montana, July 27, 1891. Head, 4 to 4¼ in length to base of caudal; depth, 3½ to 3¾; eye, 3½ to 4 in head, 1½ in interorbital width; snout, 3½ to 3¾; D. 10 (occasionally 9 or 11); A. 14 (13, 15, or 16 in a few specimens); scales, 11–66–7; teeth, 2, 5–4, 2. Body compressed, deep, back little arched, ventral line considerably curved, bending gently upward at beginning of anal fin; head heavy, snout short and blunt, lower jaw not projecting, mouth oblique, maxillary not quite reaching front of orbit; caudal peduncle long and slender; scales moderate, deeper than long on anterior part of body, but longer than deep on caudal peduncle, about 32 before the dorsal. Dorsal fin small, much nearer caudal fin than snout, about midway between beginning of scaled surface at back of head and beginning of rudimentary caudal rays, its origin behind vertical line from ventrals a distance equal to the length of its base; base of dorsal fin 1⅜ in its height, which in turn is 1¼ in head; its free margin falcate. Anal fin large, its base about 5¾ in length of body to base of caudal fin, or about equal to length of pectoral; longest rays a little shorter than length of fin; free margin very nearly straight; origin of fin under last fifth of dorsal; ventrals short, 1½ in head, reaching vent in some specimens; pectorals long, 1⅕ in head, nearly reaching ventrals in some examples; caudal fin very long and deeply forked, lower lobe the longer, 4¼ in total length.

Color in alcohol, upper parts dark down to level of eye; beginning at upper level of eye is a band about one scale in width that is chrome yellow on head, then widening slightly and becoming rosy until the middle of the side is reached, where it becomes gradually less distinct until hardly discernible on the caudal peduncle; below this is a dark band about twice as wide, the middle portion of which lies just above the lateral line, but at each end it extends a little below; side of body below lateral line rich rosy with tinge of yellow, whitening on the caudal peduncle; orange at base of ventrals and pectorals, the latter with some reddish; belly white; cheek with a large crescent of chrome yellow, very bright in some specimens, extending from angle of mouth across the cheek and up back of the eye, nearly connecting with the line first described; opercles silvery, with some little orange washing, covered over with many fine black punctulations, most numerous above, where they form a large dark blotch; whole body sprinkled over with similar black specks, most numerous above the lateral line; lower jaw and branchiostegal membranes with numerous very fine dark specks; lower border of orbit dark; dorsal, anal, caudal, and ventral fins with a few fine black points; pectorals slightly yellowish green, with few black specks, the outer ray edged with black; a yellow blotch at base of pectoral extending forward to gill-opening.

This species is closely related to *Leuciscus montanus* (Cope), but differs from it in the shorter maxillary, smaller eye, greater width of the interorbital space, the shorter head, and the much greater depth. Compared with specimens of *L. montanus* from Utah Lake and Bear River, at Evanston, Wyoming, and with specimens of *Squalius tænia* (Cope) from Utah Lake, the snout is much more blunt and the anal fin larger. It is also related to *Leuciscus hydrophlox* (Cope), but the body is much deeper, the snout is very much blunter, the lower jaw does not project, and the lateral line is considerably more decurved; the dorsal fin in *L. hydrophlox* is midway between snout and base of caudal fin, while in this species it is placed midway between posterior line of head and base of caudal; there is also a difference of one in the number of dorsal rays; the anal fin is very much larger and the number of rays greater than in *L. hydrophlox*, from which it also differs notably in the brilliancy of its coloration.

In the following table I give measurements of the fourteen specimens:

Length in inches.	Head in length.	Depth in length.	Eye in head.	Snout in head.	Base of anal in length.	Dorsal rays.	Anal rays.
4¼	4+	3⅓	4	4	5¾	9	14
4¼	4+	3½	4—	4	6	10	15
4⅛	4¼	3¾	3¾	3¾	6	10	14
4	4	3¾	3⅓	4	5¾	10	14
4	4	3¾	3⅓	4	5¾	10	14
4	4	3¾	3¾	3¾	5⅓	10	14
4	4+	3¼	4	4	5¼	9	14
4	4⅕	3¾	4	4	5½	10	14
4	4¼	3¾	3¾	3¾	5½	10	14
4	4	3⅓	3¾	3¾	5	9	13
3⅛	4¼	3¼	3¾	3¾	5¾	10	14
3⅛	4⅕	3¾	3¾	3¾	5½	10	14
3⅛	4¼	3¾	3⅓	3⅓	5	9	13
3	4	3¾	3⅓	3½	5½	11	16

One small specimen, 1⅝ inches in length, from the outlet of Swan Lake, near Flathead Lake, seems to belong to this species. Head, 4; depth, 4; eye, 2¾, greater than snout; the mouth more oblique than in the Browns Gulch specimens; the maxillary barely reaching the eye; body much compressed.

I may add that I have made a careful comparison of the specimens of *Clinostomus montanus* Cope from Utah Lake and Bear River, at Evanston, Wyoming, and those called *Squalius tænia* (Cope), from Utah Lake, which are in the National Museum, and I can not see any differences between them.

I take pleasure in naming this handsome minnow for Dr. Theodore Gill, whose studies have added so much to our knowledge of fishes.

10. Leuciscus atrarius (Girard). (Pl. xx.)

Siboma atraria Girard, Proc. Acad. Nat. Sci. Phila. 1856, 208; P. R. R. Survey, x, 297, 1858 (spring in Utah); Cope, Zoöl. Wheeler Survey, v, 667, 1875.

Squalius atrarius, Jordan and Gilbert, Proc. U. S. Nat. Mus. 1880, 461 (Utah Lake); Synopsis, 241, 1882.

Leuciscus atrarius, Jordan, Bull. U. S. Fish Com., IX, 48, 1891 (Heart Lake and Witch Creek, Yellowstone Park).

Tigoma obesa Girard, Proc. Acad. Nat. Sci. Phila. 1856, 206; P. R. R. Survey, x, 290, 1858 (Salt Lake Valley, Utah).

Squalius obesus, Jordan and Gilbert, Synopsis, 237, 1882.

Tigoma squamata Gill, Proc. Bost. Soc. Nat. Hist. 1861; Ichthyol. Capt. Simpson's Expl., 405, 1876.

Squalius squamatus, Jordan & Gilbert, Synopsis, 241, 1882.

Squalius cruoreus Jordan and Gilbert, Proc. U. S. Nat. Mus. 1880, 460 (Utah Lake; young specimens).

Squalius rhomaleus Jordan and Gilbert, Proc. U. S. Nat. Mus. 1880, 461 (large specimens from Utah Lake); Synopsis, 240, 1882.

Siboma atraria longiceps Cope, Zoöl. Wheeler Survey, v., 667, 1875.

This species is represented in the collection by nine large specimens taken with the hook in Jackson Lake, and by numerous smaller specimens from the small creek at the head of Jackson Lake, and from Snake River at President Camp. It is very abundant in Jackson Lake and takes the hook readily.

Measurements of nine specimens.

No.	Length in inches.*	Head in length.	Depth in length.	Eye in head.	Snout in head.
27	11	3¾	4	6	4½
28	12	3¾	4	6—	3¾
29	11	4	3¾	6	4
30	10½	4	4+	6—	4
31	9	4	4+	5½	4
32	11	4	4	6	3¾
33	13	4	4+	6	3¾
34	12	4	4+	6—	3¾
35	11	4	3½	6	3¾

Scales, 11 to 13–56 to 63–6 or 7; 12–63–7 being the most usual number.

Teeth, oftener 2, 5–4, 1 than 2, 5–4, 2.

I have compared these specimens with those collected by Dr. Jordan in Heart Lake and find them identical. Girard's type of *Siboma atraria*, a specimen 6½ inches long, from "near 38° latitude, in Utah," agrees well with these, as do also others collected at Willow Springs, Utah, by Dr. G. K. Gilbert, and those called *S. rhomaleus* by Jordan and Gilbert. Specimens in the National Museum, labeled *Squalius squamatus* Gill, from Utah, are evidently *atrarius*. An examination of the type of *Squalius cruoreus* J. and G. shows it to be a little more slender than other examples of *atrarius*, but it differs in no other particular. Specimens in the Museum collected in Beaver River, Utah, by Henshaw and Yarrow, and called *Squalius egregius* Cope, can not be distinguished from *atrarius*, and that species should probably go in the above synonymy.

The type of Girard's *Cheonda cœrulea*, from Lost River, Oregon, is a very different-looking fish. The head is longer, the snout much longer and more pointed, the mouth is larger, the maxillary is longer and less oblique, the eye is somewhat larger, and the top of the head more flat.

11. Coregonus williamsoni Girard. (Pl. XXI.)

The collection contains specimens of whitefish from the following localities:

a. Swan River below Swan Lake, Montana	21
b. Jocko River, Ravalli, Montana	6
c. Big Blackfoot River, Bonner, Montana	3
d. Little Blackfoot River, Elliston, Montana	12
e. Cottonwood Creek, Deer Lodge, Montana	1
f. Snake River, President Camp, Wyoming	19
g. Red Rock River, Red Rock, Montana	7
h. Beaverhead River, Dillon, Montana	5
i. Junction of Firehole and Gibbon rivers	2

In addition to the material collected by us, I have examined numerous other specimens from the Upper Missouri Basin, comparing them with a large number from the upper tributaries of the Columbia, but I am unable to find any difference of value. The Columbia specimens are perhaps somewhat deeper. Examples from Red Rock and Beaverhead rivers have the head 4½ (4 to 4⅗); depth, 4⅕ to 4⅘; scales, 80 to 84. Those from Little Blackfoot and Swan rivers have the head 4⅕ to 4½; depth, 4 to 4⅕; scales, 80 to 84.

Small specimens, 3 to 5 inches long, show the following color markings: Silvery over entire surface below the lateral line, with a few scattered dark punctulations and a little black on lower caudal rays, plainest toward the base; bluish above lateral line, with numerous larger and darker punctulations; under these are seen the vanishing bluish blotches so evident in younger examples. Dorsal and adipose fins, as well as snout and top of head, covered with very fine dark spots. Younger specimens, a little under 3 inches in length, have the steel-blue blotches very distinct, there being about 10 of them, most of which just touch the lateral line from above; above these are about 20 similar blotches of various sizes—mostly smaller, however, than those along the lateral line.

A still smaller specimen (2½ inches) in life was silvery below, 8 or 9 dark-bluish spots along side, mostly above lateral line; back darker, with numerous spots; top of head with very fine spots.

The fact that the young whitefish has the *parr* markings is a very interesting one, and is of value in showing its relations to the trout. (See Pl. XXI.)

12. Thymallus signifer (Richardson). (Pl. XXII.)

We found the grayling in Red Rock River, Beaverhead River, and in the Gibbon at its junction with the Firehole River; and also in the stream formed by Horsethief Springs—all tributary to the Upper Missouri.

Two examples, 10 and 11 inches long respectively, from the junction of the Firehole and the Gibbon, show some differences in measurements; the larger has the head 4¾; depth, 4; eye, 4⅓; scales, 8–97–10, and dorsal 19; the other, head, 4⅗; depth, 3⅘; eye, 4½; scales, 8–91–10, and dorsal 19. Length of dorsal fin a little greater than head, height about 1½ in head, but much less than depth of body; origin of dorsal one-third length of body from snout. About 18 inky black spots and about 6 fainter ones on side of body. The number of these spots is of little value, however, as the smaller of these two specimens has 25 distinct spots on one side and but 18 on the other; nearly all the spots are anterior to the dorsal fin.

A small specimen (3 inches long) from Beaverhead River has the depth and head about equal, each 4 in length of body. Upper half of its body covered with fine dark specks, most numerous on edges of scales where they form a dark border; along the region of the lateral line is a series of about fifteen steel-blue blotches, the vertical diameter greatest, much resembling the *parr* markings of young trout and whitefish. Above these are many smaller spots or blotches of same color. (See Pl. XXII.)

Two specimens, 3⅛ and 3½ inches long respectively, from Red Rock River, have the steel-blue blotches very distinct, while the dark borders or lines between the rows of scales on the upper half of body have begun to break up into short, inky, zigzag lines each with one to eight or more angles.

13. Salmo mykiss Walbaum. (Pl. XXIV.)

The black-spotted or mountain trout is represented in the collection by specimens from the following localities:

a. Swan River below Swan Lake, Montana	8
b. Flathead Lake	2
c. Mission Creek near Ravalli, Montana	1
d. Jocko River, Ravalli, Montana	20
e. Rattlesnake Creek, Missoula, Montana	7
f. Lolo Creek, Missoula, Montana	9
g. Big Blackfoot River, Bonner, Montana	1
h. Little Blackfoot River, Elliston, Montana	12
i. Cottonwood Creek, Deer Lodge, Montana	19
j. Dempsey Lakes, Deer Lodge, Montana	12
k. Browns Gulch Creek, Silver Bow, Montana	3
l. Lewis River just below Lower Falls	2
m. Crawfish Creek just below Moose Falls	2
n. Snake River, President Camp, Wyoming	9
o. Pacific Creek 25 miles below Two-Ocean Pass	6
p. Pacific Creek about 8 miles below Two-Ocean Pass	3
q. Pacific Creek at Two-Ocean Pass	16
r. Atlantic Creek at Two-Ocean Pass	20
s. Atlantic Creek 1 mile above its mouth	1
t. Mouth of Upper Yellowstone River	2
u. Meadow Creek near its mouth	6
v. East Fork Gardiner River above falls	1
w. McClellan Creek near Helena, Montana	2

This species is found abundantly in all suitable streams and lakes explored by us.

Besides the 135 specimens from the Columbia basin and the 32 from the Missouri side, a great many individuals were examined in the field which were not preserved. In addition to the above, numerous specimens in the collections in the U. S. National Museum were compared with those of my own collection. The whole amount of material examined goes to show the correctness of the conclusion reached by Dr. Jordan,* that all the native trout of the Park belong to a single species, and that *Salmo clarkei*, *Salmo lewisi*, etc., can not be recognized even as varieties.

The fact that there is a free waterway over Two-Ocean Pass, by means of which trout can pass readily from either side of the "Divide" to the other, as explained elsewhere in this report, is of great importance in showing that the trout of the two sides can not be regarded even as geographical forms. The differences that are observable among different specimens do not exist as differences between Missouri and Columbia drainage specimens, but rather as slight peculiarities due to the nature of each particular stream. This will appear evident from a comparison of the following color notes, based upon specimens of different sizes and from different places:

A specimen 4¾ inches long, from McClellan Creek, Helena, Montana: Side with about ten dark blotches lying on the lateral line, the vertical diameter being the greater; a series of about a dozen larger, rounder ones along middle of space between lateral line and middle line of back; among and about these are numerous small spots; spots below lateral line not numerous, about ten large and perhaps twice as many small ones; cheek with two or three small dark spots and numerous fine punctulations; a few small spots on top of head; dorsal fin with about a dozen small spots or blotches; adipose fin dark-edged; caudal fin well spotted, the spots more or less evidently arranged in five vertical rows; other fins plain; tip of lower jaw dark.

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* Bull. U. S. Fish Commission, vol. IX, 50, 1891.

A specimen, 7 inches long, from the same place, differs from the smaller one in having the large vertical blotches less distinct, and the other spots more numerous, especially on dorsal, adipose, and anal fins, and on top of head; the spots on the cheeks are also less distinct.

Twenty specimens, each about 4½ inches long, from Atlantic Creek in Two-Ocean Pass, show no marked differences from those from McClellan Creek. The spots are a little larger in some specimens; the large blotches seem a little less distinct than in the larger, but much the same as in the smaller specimen from McClellan Creek. Those from Atlantic Creek are a little more slender than the others.

A specimen 2¾ inches long, from Atlantic Creek, about one mile from its mouth, does not differ in color from those taken in the same creek at Two-Ocean Pass.

Sixteen specimens, 4 to 6½ inches long, from Pacific Creek, in Two-Ocean Pass, can not be distinguished from those of the same size taken in Atlantic Creek, a few yards away.

Three examples taken in Pacific Creek, about 7 miles below the pass, and measuring 5½ and 6½ inches in length, have the spots less numerous and larger, agreeing in this with the Atlantic Creek specimens.

A specimen 14 inches long from Pacific Creek, about 25 miles below the pass, presented the following life colors: Above, dark greenish, very dark on head, lighter posteriorly; paler on sides, nearly white on belly, but with some dark washings. No spots on top of head, very few on body in front of dorsal, more numerous behind; ten or eleven small round spots on cheek. Sides of head with red or pinkish wash, old gold at upper edge of opercle and a blotch of the same behind the eye. Shoulder above pectoral reddish; throat white, with red gash; rim of lower jaw washed with dark. Pectorals dark wine color; ventrals and anal red. Spots on body nearly round.

Another specimen, 11½ inches long, from same place, was, in life, dark-greenish above, silvery on the sides, but with an underwash of yellowish; belly white; few, if any, spots on head or on back in front of dorsal, and but few on anterior half of body, while they are rather thick under the dorsal and quite thick along the back between the dorsal and caudal fins; not over fifty spots altogether below the lateral line; dorsal and caudal fins well spotted; two dark blotches on cheek; opercles pinkish, yellowish at top; red gash on throat not heavy; pectorals dark, ventrals and anal yellow.

Another specimen, 12 inches long, was yellowish like the one just described, but had the spots more numerous and not so nearly round, each spot being made up of two or more short black lines joined in such a way as to make the spots appear somewhat star-shaped at first glance.

An examination of about thirty large individuals from this place seemed to show that they may be separated into two groups: one more slender, and yellowish in color; the other less slender and with little or no yellow. The star-shaped spots seemed to be more common among the yellow examples, but all were not so marked, nor was this style of marking absent from the other form.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Swan lakes. This extends its known range considerably eastward. The following table gives measurements of six specimens from Rattlesnake Creek:

No.	Length in inches.	Head in length.	Depth in length.	Eye in head.	Maxillary in head.	Interorbital space in head.	Snout in head.	Pectoral fin in head.	Ventral fin in head.	Anal fin in head.	Longest dorsal ray in head.
53	10	3¾	4⅔	5¼	2	3¾	3¾	1⅔	2	1⅞	1¾
54	7¼	3¾	4⅔	5+	2	3¾	4	1⅔	2¼	1⅞	1¾
55	7¾	3¾	4⅔	5+	2	3¾	4+	1⅔	2¼	2	1¾
56	6¾	3¾	4⅔	5	2	4	4½	1⅔	2¼	2	1¾
57	7¾	3¾	4½	5	2	3½	4	1⅔	2¼	2	1¾
58	7¼	3¾	4⅔	5	2	3¾	4	1⅔	2¼	1⅞	1¾

Color, in alcohol, of No. 53, which is not unlike the others: Dark gray, darkest on head and body in front of dorsal fin, becoming lighter below; yellowish white on belly; sides with about three longitudinal rows of orange or reddish spots, each about ⅛ of an inch in diameter; these rows are irregular, but in general it may be said that the upper row lies along the middle of the space between the dorsal fin and the lateral line, the second one along the lateral line, and the third about midway between the lateral line and the level of the origin of the pectoral fin; there are a few other spots that do not lie evidently in any of these lines; those on upper part of body smaller than those below. Besides the orange spots, the body is well covered with numerous dark punctulations, especially abundant on sides of head, fins, and lower parts of body; median line of belly, plain yellowish white; branchiostegals and lower jaw with some punctulations; upper parts of pectorals and ventrals darker than lower. Comparing these with specimens of same size from McCloud River shows the Rattlesnake Creek specimens to be much more slender (those from McCloud River having the depth 3¾ to 4⅓ in length), the eye a little larger and the color darker.

Specimens of "salmon trout" weighing 12 and 14 pounds have been taken from the Bitter Root River, near Missoula.

15. Cottus bairdi punctulatus (Gill). (Pl. XXII.)

Potamocottus punctulatus Gill, Proc. Bost. Soc. Nat. Hist. 1861, 40 (Bridger Pass).
Cottus bairdi punctulatus, Jordan, Bull. U. S. Fish Com., IX, for 1889, 29, 1891.

Numerous specimens of the blob, or "bullhead," as it is known in Montana where known at all, were obtained from the following localities:

a. Beaverhead River, Dillon, Montana	76
b. Red Rock River near Red Rock, Montana	20
c. Cañon Creek, Yellowstone National Park	9
d. Junction of Firehole and Gibbon Rivers	19
e. Pacific Creek in Two-Ocean Pass	4
f. Pacific Creek 25 miles below the Pass	5
g. Small Creek at head of Jackson Lake	21
h. Snake River, President Camp, Wyoming	2
i. Browns Gulch Creek, Silver Bow, Montana	2
j. Cottonwood Creek, Deer Lodge, Montana	32
k. Little Blackfoot River, Elliston, Montana	57
l. Rattlesnake Creek, Missoula, Montana	11
m. Lolo Creek near Missoula, Montana	13
n. Jocko River, Ravalli, Montana	7
o. Swan River at outlet of Swan Lake, Montana	15

It was also seen in Horsethief Springs and in Gardiner River below the falls.

The specimens from Red Rock and Dillon are very large, measuring from 3 to 4½ inches in length, while those from the head of Jackson Lake are all very small, as are most of those from Pacific Creek.

In numerous specimens examined the head is a little shorter than indicated by Dr. Gill's description, it being 3½ instead of 3 in body to base of caudal. There are also other slight differences; the dorsal is VI or VII-17 or 18, and the anal 12 or 13. The length of the head is just about equal to its width measured at the preopercular spines; the pectoral fins 1½ in head, the rays extending markedly beyond the interradial membrane. In most specimens the black spots are evident, but some seem to be almost or entirely without them; a dark blotch at base of caudal, and three or four on the side are very plain in some individuals. One of the specimens, 2½ inches long, from Rattlesnake Creek, is greatly distended with nearly ripe eggs, which gives us some idea as to their time of spawning in that region. Some of the specimens from this place, and others from the outlet of Swan Lake, have the visceral cavity completely filled by a parasitic worm more than an inch in length, in blobs that are not over 2 inches long. Some of these parasites were sent for identification to Prof. Linton, who says:

> The parasite in the abdominal cavity of the fish is *Schistocephalus dimorphus* Creplin. It is immature. Like *Dibothrium cordiceps* Leidy, of the trout, it attains the adult stage in the intestine of fish-eating birds. This, so far as I know, is the first find of this worm in America. In Europe it has been found most commonly in *Gasterosteus.*

16. **Lota lota maculosa** (Le Sueur). (Pl. XXIV.)

Gadus maculosus Le Sueur, Journ. Acad. Nat. Sci. Phila., I, 83, 1817.

A single specimen of the ling was taken in the Red Rock River, and it is said by Mr. Scott, of Red Rock, to be common in Red Rock Lake, in which the river has its origin. While this is a very widely distributed fish, it has not been previously reported from any point near the headwaters of the Missouri. Head, 4½; depth, 6½; eye, 6½; snout, 4. The maxillary reaches the posterior edge of the pupil; the barbel is a little longer than the eye; pectorals 1⅔ in head, and about equal to the ventrals.

Specimens of the following species, introduced into the waters of the Yellowstone National Park by the U. S. Fish Commission in 1889 and 1890, were taken and are now in the collection:

17. **Salmo irideus** Ayres. Rainbow trout. (Pl. XXIII.)

Two specimens from Gibbon River above Gibbon Falls.

18. **Salmo trutta levenensis** Walker. Loch Leven trout. (Pl. XXIV.)

One specimen from mouth of Heron Creek, Shoshone Lake.

19. **Salmo fario** Will. Von Behr trout; Brown trout. (Pl. XXIII.)

One yearling specimen from Firehole River, above Old Faithful Geyser.

20. **Salvelinus fontinalis** Mitchill. Eastern brook trout. (Pl. XXV.)

One specimen 12 inches long from Indian Creek, near its mouth.

RESULTS OF STOCKING THE WATERS OF YELLOWSTONE NATIONAL PARK WITH FISH.

In 1889 and 1890 yearling fish were placed by the U. S. Fish Commission in the waters of the Yellowstone National Park, as follows:

Date.	Place.	Kind of fish.	Number.
Sept. 22, 1889	Gardiner River	Brook trout	4, 975
Sept. 15, 1890	West Fork of Gardiner River	......do	7, 875
Sept. 22, 1889	Gibbon River	Rainbow trout	990
Do	Firehole River	Loch Leven trout	995
Sept. 2, 1890	Lewis Lake	......do	3, 350
Do	Shoshone Lake	......do	3, 350
Sept. 22, 1889	East Fork Gardiner River	Mountain trout	968
Aug. 9, 1800	Shoshone Lake	Lake trout	18, 000
Aug. 23, 1890	......do	......do	7, 262
Do	Lewis Lake	......do	7, 263
Sept. 2, 1890	......do	......do	4, 750
Do	Shoshone Lake	......do	4, 750
Sept. 15, 1890	Nez Percé Creek	Von Behr trout	9. 300
Oct. 3, 1889	Twin Lakes	Native whitefish	2, 000
Oct. 15, 1889	Yellowstone River	......do	980
Aug. 15, 1890	......do	......do	5, 000
Sept. 11, 1890	......do	......do	5, 000

Excepting the Yellowstone and Gibbon rivers, and possibly the East Fork of the Gardiner, there were no fish whatever in any of these streams or lakes, the falls that are found in each having apparently proved effective barriers in preventing fishes from ever reaching the waters above. The only species known from the Upper Gibbon River is the little blob or miller's thumb, while the native mountain trout was well known to be abundant in the Yellowstone River, above the falls as well as below. Each of these bodies of water is practically so isolated from the others that fish can not pass from one to another. The Commissioner, therefore, planted a different species in each basin, except in Lewis and Shoshone lakes, where two species were placed. This will greatly simplify any observations that it may be desired to make upon them at any time.

One of the principal purposes of our visit to the Park was, as directed by the Commissioner, "to make such examinations as are possible with a view to determining what success has attended the plantings of fish already made in that reservation." I visited the different places where the plants were made, and am able to report that, as a whole, the work of the Commission in that region has proved very successful. At least five of the seven species planted are doing well, and we have no reason to think that a sixth species (lake trout) is not also doing equally well. We obtained specimens of brook, Loch Leven, rainbow, and black-spotted native trout, and learned that the Von Behr trout, which was put in Nez Percé Creek, have been seen at different times this year by several persons.

At least the brook and Loch Leven trout, which were planted in 1889, spawned in 1890, as we found young of these species that could not be over a year old. All of the specimens we took were in excellent condition, thus showing that the waters are suitable and the food supply abundant.

It is doubtful if any of the whitefish that were transplanted from Horsethief Springs to Twin Lakes and Yellowstone River have survived. Each of these places was examined, and we made careful inquiry of persons who had opportunities for knowing, whether they had seen any whitefish in Yellowstone River, but none had been seen and no one believes any are there. Every one inquired of is of the opinion that the whitefish fell a ready prey to the voracious native trout which abound in that stream. Their failure to thrive in Twin Lakes is probably due to the mineral character and high temperature of the water.

Upon the whole, the Commission is certainly to be congratulated upon the high degree of success which has attended its efforts toward supplying valuable food-fish to these hitherto barren waters.

Following is the detailed account of our investigations:

Gardiner River.—This stream was stocked September 22, 1889, with 4,975 young brook trout. Our examinations were made on Indian Creek, at and above the mouth of Obsidian Creek, and along Obsidian Creek in Willow Park. We saw at least five trout near the mouth of Indian Creek, one of which was caught. This one was a foot in length, and the others seen were estimated to be at least 9 inches long. These streams were so rocky and the current so swift that it was not possible to use the seine to any advantage. In Winter Creek we saw two small trout, each perhaps 6 inches long or less. From these facts it is evident that the brook trout is thriving in these streams (all branches of the Gardiner River) and that the fish planted in 1889 spawned in 1890, the small specimens seen being yearlings. I should add that the large specimen caught was full of spawn.

Gibbon River.—This stream was stocked with 990 rainbow trout September 22, 1889, the plant being made just above Virginia Cascade. We examined the stream for some distance both above and below the cascade. One trout (a male, 10½ inches long) was taken about one-eighth of a mile above where the plant was made, and another male of the same size was taken about the same distance below the cascade. Four others of apparently the same size were seen above the cascade, and at least five others, equally large, below it. Owing to the nature of the stream, all of our fishing here had to be done with the fly. Other persons familiar with Gibbon River report seeing fish in it this year.

Firehole River.—A plant of 995 Loch Leven trout was made September 22, 1889, in this stream above Keppler Cascade. We seined the river below the cascade, near Old Faithful Geyser, and caught one example, 3½ inches long. We also fished with the fly for some distance along the stream above the cascade, and, though no specimens were secured, the two small trout (not over 4 inches long) which rose to the fly are sufficient evidence that this plant has also proved successful. The fish of the plant certainly spawned last year, as the one specimen secured, as well as the others seen, are yearlings.

Nez Percé Creek.—On September 15, 1890, 9,300 Von Behr trout were placed in this creek. We examined the stream just above the "Soldiers' Camp" near the Fountain Hotel, but were unable to find any fish. Lieut. Pitcher, who was stationed here, assures us, however, that fish have been seen in the stream this year. On October 9, of this year, Mr. Elwood Hofer saw trout in this creek.

Shoshone and Lewis Lakes.—In August and September, 1890, there were placed in these lakes 6,700 Loch Leven and 42,025 lake trout. In the mouth of Heron Creek, at the north end of Shoshone Lake, I saw a great many young trout, apparently 5 to 6 inches long. In one bunch there were at least 50. One specimen was caught which proved to be a Loch Leven trout, 5½ inches long. We were not certain that we saw any fish in the lake, but on October 7 Mr. Hofer was passing along the east shore of Shoshone Lake and reports seeing several trout rise to the surface out about 75 yards from the shore. He also reports seeing trout at a beaver dam in Heron Creek about 1½ miles from the lake. Whether any of these were lake trout could not be certainly determined, but the probabilities are that those seen in the lake were lake trout, while those in the creek were Loch Leven trout. Finding them so numerous in the creek would seem to be very satisfactory and positive evidence of the success of this important planting.

East Fork of Gardiner River.—This stream was stocked September 22, 1889, with 968 native trout gotten by Mr. Lucas from Howard Creek. We made a somewhat hurried examination just above Undine Falls and caught one trout, 6½ inches long. There seems to be a question as to whether this stream did not already contain trout before this plant was made. The nature of the divide between this stream and Blacktail Deer Creek, in which there are no falls, makes it quite possible for trout to get over from Blacktail Deer Creek, which is well supplied with trout. This, of course, makes it impossible to say whether the trout taken by us is of the plant or not.

NOTES ON MAMMALS NOTICED IN MONTANA AND WYOMING.

Though no special attention was given to the mammals found in the region traversed by us, no specimens collected, and no special attempt made to list the species of the region, yet numerous notes were made upon some of the species observed. Such of these notes as seem to be of value are given here.

1. **Arctomys** sp.?

Ground hogs were seen in several places south of the Yellowstone National Park. On Pacific Creek, not far below Two-Ocean Pass, we saw a pair of old ones and four or five half-grown young, one of which our dog killed. Dr. Merriam informs me that the marmot found there is probably *Arctomys dakota.*

2. **Tamias** sp.?

Chipmunks were frequently seen about Flathead Lake, on Dempsey Creek, at Missoula, and perhaps other places. Two different species were probably seen.

3. **Sciurus richardsoni** Bachman?

A squirrel, likely this species, was abundant at Swan and Flathead lakes, Missoula, and the National Park.

4. **Castor canadensis** Kuhl.

Fresh signs of beaver were seen at Beaver Lake, Willow Park, and on Lewis River just below the Upper Falls; also near the mouth of Beaverdam Creek.

5. **Lagomys princeps** Rich. Rocky Mountain pika.

Several were seen near Obsidian Cliff in National Park; and four or five others were noticed in a rocky slide on the divide between Shoshone Lake and the Firehole River.

6. **Cervus canadensis** Erxleben.

A drove of sixteen elk was seen on Pacific Creek below Two-Ocean Pass. Several young elk were seen at Horsethief Springs. They had been captured in the mountains near by and were being raised by hand by Mr. Marshall. This man does quite a thriving business rearing elk and deer in this way and selling them to owners of private parks in the East.

7. **Cariacus macrotis** (Say). Black-tail deer.

Seen on Swan River (one doe, one fawn, and one old buck). The old buck when first seen was standing in the road just ahead of us. As we drove toward him he made a few bounds and stopped behind the top of a fallen pine tree not over 40 feet from the road, and there he remained while we drove by and on down the road. Two others were seen within a few rods of the hotel at the Mammoth Hot Springs. Others were seen at various places about the Park.

8. **Antilocapra americana** (Ord). Antelope.

Several were seen on Pacific Creek, between Jackson Lake and Two-Ocean Pass.

9. **Ovis canadensis** Shaw. Mountain sheep.

A skull was found near our camp on Dempsey Creek near Mount Powell.

10. **Bison bison** (L.). Buffalo.

None were seen in the Park, but it was reported, August 23, that a herd had been seen about that time on the east side of Yellowstone Lake. Charles Allard, a half-breed, who runs the stage line from Ravalli to Flathead Lake, has a herd of about 70 on his ranch on the Flathead Reservation. We were told that he was very successful in crossing them with domestic cattle.

11. **Canis latrans** Say. Coyote.

Heard at Silver Bow and Deer Lodge.

12. **Gulo luscus** (L.). Wolverine.

August 21, I saw one on the east shore of Yellowstone Lake near Steamboat Point.

13. **Mephitis** sp.?

President Camp, on Snake River; also near Polecat Creek.

14. **Taxidea americana** (Bodd.). Badger.

One seen near Steamboat Point, August 21.

15. **Ursus americanus** Pallas. Black bear.

One seen one evening at the Lake Hotel. He had come up to feed at the swill barrel. Another seen on Lewis River below Upper Falls. Fresh bear tracks were also seen on Big Blackfoot River, above Bonner.

16. **Erethizon epixanthus** Brandt. Porcupine.

One dead one seen on east side of Yellowstone Lake. At various places in the Park, and especially in the heavy pine forests south of the Park, about Shoshone, Lewis, and Yellowstone lakes, a great many pine trees were seen from which great patches of bark had been eaten away. These barkless areas frequently, perhaps usually, encircled the tree and were at various heights above the ground, from only a few inches to 25 to 35 feet; generally, however, the height was 8 to 15 feet. Mr. Hofer and the other men of our party say that this is the work of porcupines and that the place indicates the depth of the snow.

ANNOTATED LIST OF REPTILES AND BATRACHIANS COLLECTED.

[By Frederick C. Test, Aid, Department of Reptiles, U. S. National Museum.]

The collecting of Reptiles and Batrachians was merely an incidental feature of the work of the party. No time was devoted to searching for specimens of these groups, and those found in the collection are such as the members of the party chanced to see while carrying on the main work of the expedition. Only a short time was spent at each locality and only the most common forms were found. The Batrachians greatly predominate, and the series of *Rana pretiosa* is an especially good one.

I wish here to express my thanks to Dr. Leonhard Stejneger for aid and suggestions in preparing these notes.

1. **Eutænia sirtalis parietalis** Cope.

Two typical adult specimens of this species were collected.

Museum No.	Collector's No.	Locality.	Date.
17566	8	Swan River, near Swan Lake, Montana	Aug. 3
17567	9	......do	Do.

2. **Eutænia vagrans** B. and G.

Of this species there are five specimens of varying ages and sizes.

Museum No.	Collector's No.	Locality.	Date.
17565	7	Swan River, near Swan Lake, Montana	Aug. 3
17568	10	......do	Do.
17569	74	McClellan Creek, near Helena, Montana	July 20
17570	75	......do	Do.
17571	76	......do	Do.

3. **Ambystoma tigrinum** Green.

Of this widely spread and usually abundant species, only four specimens were found, all larvæ.

Museum No.	Collector's No.	Locality.	Date.
17583	6	Jocko River, Ravalli, Montana	July 31

4. **Bufo halophilus** Baird.

Three typical specimens.

Museum No.	Collector's No.	Locality.	Date.
17634	15	Lewis Falls, Wyoming	Aug. 12
17635	16	......do	Do.
17636	66	President Camp, Wyoming	Aug. 13

5. **Rana pipiens brachycephala** Cope.

The two specimens collected have some of the proportions of *R. pipiens pipiens*, the head being considerably less than 3 in the length instead of 3½, as it is said to be in *brachycephala*, but they have been referred to the latter on account of the absence of a well-defined dark bar on the front of the femur, a color feature more or less characteristic of Western specimens.

Museum No.	Collector's No.	Locality.	Date.
17572	80	Beaverhead River, Dillon, Montana	July 27
17573	....	Swan River, near Swan Lake, Montana	Aug. 3

6. **Rana pretiosa** B. & G.

Of the fifty-six specimens all but five are from streams that empty into the Pacific. These five, Nos. 17574 to 17578, are from the junction of Firehole and Gibbon rivers, the headwaters of the Madison Fork of the Missouri. This fact is particularly interesting, inasmuch as I have been able to find but three other records of this species occurring in streams flowing to the east. One of these is noted by Prof. E. D. Cope, who found it in Prickly Pear Cañon, just north of Helena, Montana. (Am. Nat., 1879, p. 435.) Another is a single specimen, U. S. National Museum, No. 11503, collected at Fort Ellis, Montana, by W. B. Pratt; and the third record consists of two specimens, U. S. National Museum, Nos. 11937 and 11939, collected by C. Hart Merriam at "Upper Firehole Basin, Yellowstone Park." In the list of specimens of *Rana pretiosa* belonging to the U. S. National Museum (see Cope's Batrachia of North America, p. 434) there are apparently two more records of this species occurring east of the Rocky Mountains, but both are due to misidentification, No. 3437, from the Red River of the North, R. Kennicott, being *R. septentrionalis*, and No. 4824, St. Catharine, Canada, D. W. Beadle, *R. sylvatica*. It may possibly be owing in part to insufficient exploration that there are so few instances of this frog being found east of the Great Divide.

In looking over this series, a very noticeable point is the lightening in color as the frog increases in age and size. The young is very dusky, the moss-agate-like dark dorsal spots being barely apparent, but as it grows the ground color pales, and while some of the black markings thus become more prominent, others fade entirely away. The largest specimen collected, No. 17603, a female from Deer Lodge River, Montana, is also the lightest colored. The ground color is very pale, rendering more conspicuous the few black dorsal blotches. The inferior dark markings are absent, and the usual bars on the legs are broken up into several small spots. There is indication of a light median line on the back posteriorly. No. 17604, a smaller female from the same locality, is much darker, with all the usual markings, and the dorsal blotches more numerous.

Four or five small specimens from Cottonwood Creek, Deer Lodge, Montana, show the darkest phase of the young very well, particularly No. 17593, a female, which has the black marbling of the throat finely marked, and all the spots on the sides and lower surface unusually distinct, while the upper ground color is so dark that the blotches on the back are hard to distinguish. No. 17591, a very slightly larger male, is almost as well marked. These differences in color are plainly not due to local causes, since dark and light come from the same locality; nor to sex, for dissection shows that the sexes are irregularly distributed among the varying shades of color.

There are a few exceptions to the general rule, notably No. 17572, a small male, which should be dark, but is quite light, and No. 17606, a rather large female, which is considerably darker than it ought to be.

Museum No.	Collector's No.	Locality.	Date.
17574	71	Junction of Firehole and Gibbon rivers, Montana	Aug. 9
17575	72	do	Do.
17576	73	do	Do.
17577-8		do	Do.
17579	68	Lolo Creek, Missoula, Montana	July 30
17580	69	Big Blackfoot River, above Bonner, Montana	July 29
17581	70	do	Do.
17582	67	Ravalli, Montana	July 31
17587-8		Little Blackfoot River, near Elliston, Montana	July 21
17589-602		Cottonwood Creek, Deer Lodge, Montana	July 22
17603-4		Deer Lodge River, Montana	Do.
17605-16		Browns Gulch, Silver Bow, Montana	July 27
17617-24		Cañon Creek, National Park, Wyoming	Aug. 8
17625	14	Foot of Shoshone Lake, Wyoming	Aug. 12
17626-7		Crawfish Creek, at Moose Falls, National Park, Wyoming	Aug. 13
17628	26	Jackson Lake, Wyoming	Aug. 14
17629	44	Two-Ocean Pass, Wyoming	Aug. 17
17630	45	do	Do.
17631	46	do	Do.
17632	48	do	Do.
17633	49	do	Do.

PRESERVATION OF FORESTS IN AND ABOUT YELLOWSTONE PARK.

According to Dr. Hayden, the Yellowstone Park region has a climate differing in many respects from that of other parts of the Rocky Mountain region. It has a very moist atmosphere, the rainfall is greater, its mean annual temperature is lower, and it is better clothed with vegetation. This region and the adjacent portions of Idaho and Wyoming constitute the most heavily timbered area in the West, excepting parts of Oregon and Washington west of the Cascade Range. The climate is, as regards temperature, subarctic. The winter begins with September and ends only in June, and frosts occur every month in the year.

On the morning of August 8, at our camp on Beaver Lake, the thermometer stood at 29° at 8 o'clock. At Two-Ocean Pass the temperature was 33° at 6:30 a. m., August 18, and nearly every night, during the time of our stay in and about the Park, the temperature was down to freezing.

According to Mr. Hague, "few regions in the Rocky Mountains are so highly favored as regards snow and rain fall. Snow falls early in October and rarely disappears before June, and throughout the winter is said to lie 6 feet in depth over the plateau and higher regions of the Park. On the evening of October 9 a storm began and continued without abatement for thirty-six hours, the snowfall measuring 36 inches. The Park is peculiarly well adapted for holding broad sheets of water. In consequence, we find here such bodies of water as the Yellowstone, Shoshone, Heart, and Lewis lakes, besides innumerable smaller ones. These lakes are the natural reservoirs for storing up the water supply. The Yellowstone Lake alone has an area of 150 [139] square miles," and the others no doubt double this area. From these numerous lakes the water is gradually fed out to the upper tributaries of the Missouri and the Columbia during the season of little rain.

Mr. Hague further says:

> Forests cover the hills to the water's edge. The timber retains the snow late in the season, while it slowly melts away and fills the springs and lakes. If the forests are removed the snow will rapidly disappear under the direct rays of the sun by evaporation, and it will be largely carried off by the dry west winds which prevail. There would be enormous freshets in the spring, followed by a long parched season, the lakes and springs diminishing rapidly.

In another place Mr. Hague, who has given much attention to this important question, says:

> I know of no tract in the Rocky Mountains where the necessity for the conservation of the forests appears so urgent, or the direct advantage to be gained so immediate, as right here on the Park Plateau at the headwaters of the Yellowstone and the Snake rivers. If the broad valley of the Yellowstone is ever to support any considerable population the forests and streams from these elevated regions must be protected. The Yellowstone Valley can stand no diminution in the water supply which it now receives.

The importance of this matter cannot be overestimated, and it is very gratifying to know that, under authority of an act of Congress of March 3, 1891, the President has already, by proclamation, set apart and reserved from settlement a wide strip of land lying south and east of the Yellowstone Park. This important addition to the Park comprises the greater part of the densely timbered region already mentioned.

RECOMMENDATIONS.

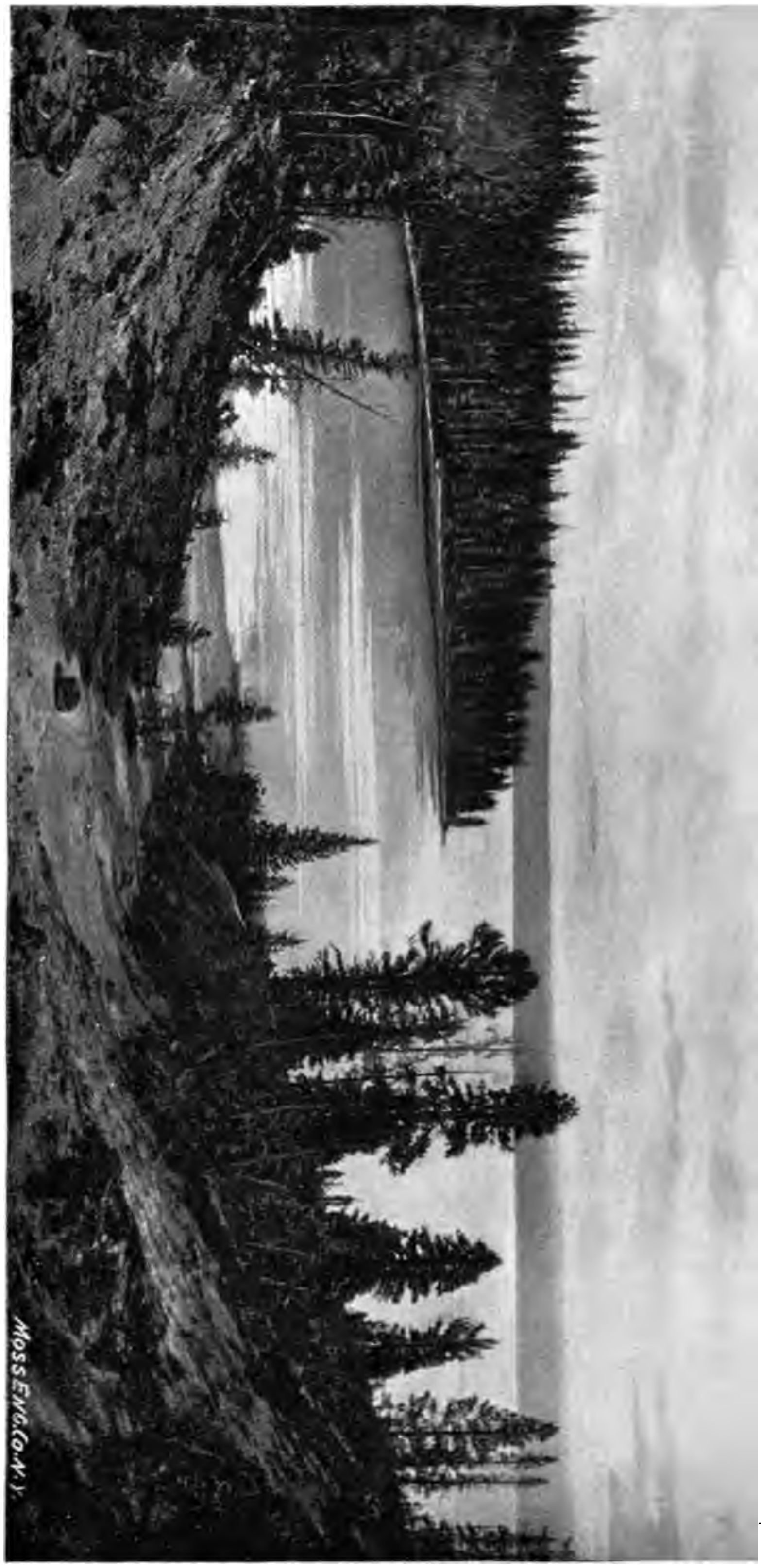
Among the many falls in and about the Yellowstone National Park, there are several in which the placing of fishways should receive consideration. Virginia Cascade and Gibbon Falls in Gibbon River, Keppler Cascade in Firehole River, and the upper and lower falls of Lewis River are of this number. All of these rivers, both above and below the falls which they contain, are ideal trout streams. Below each of the lower falls there is an abundance of excellent food-fishes—trout in the Lewis, and trout, grayling, and whitefish in the Gibbon—while above these falls there are no fish whatever, except those planted by the Commission in 1889 and 1890.

It would be comparatively an easy matter to construct a fishway at each of these falls which would enable the valuable native species to ascend to the upper courses of these streams and to the cold lakes in which most of them rise.

When sufficient time has elapsed to enable the various species of trout planted by the Commission in these waters to become thoroughly established, the desirability of placing fishways in these streams should receive careful consideration.

In the country about Cooke City, east of the National Park, are several lakes similar to those in the Park, but smaller. Clarke Fork of the Yellowstone, about the headwaters of which these lakes lie, has in it considerable falls which fish can not pass. As a result, these lakes and upper tributaries are barren of fish, and their stocking with species of *Salmonidæ* might be very properly undertaken by the Commission.

PLATE VI.

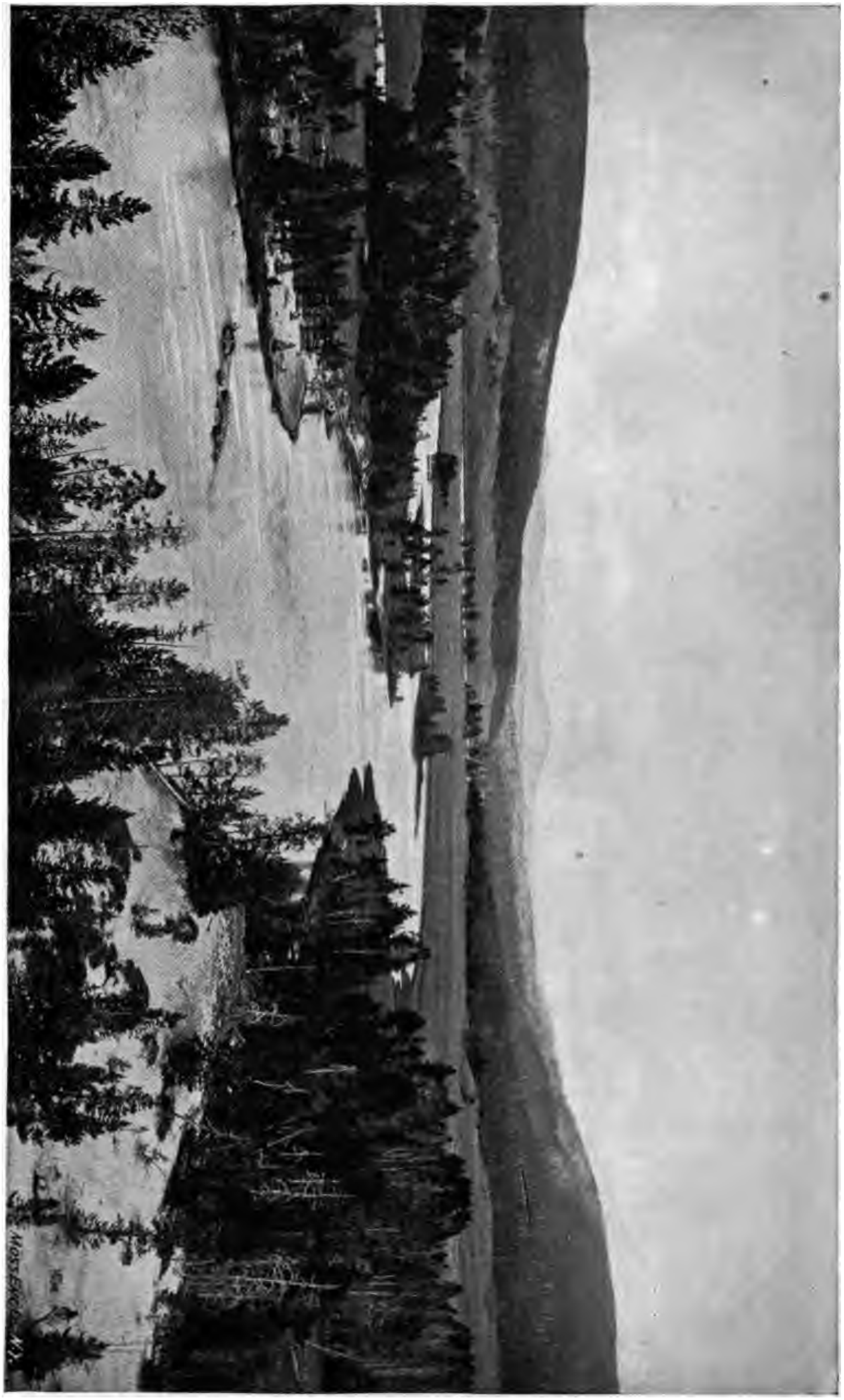


SHOSHONE LAKE, NORTH SHORE.

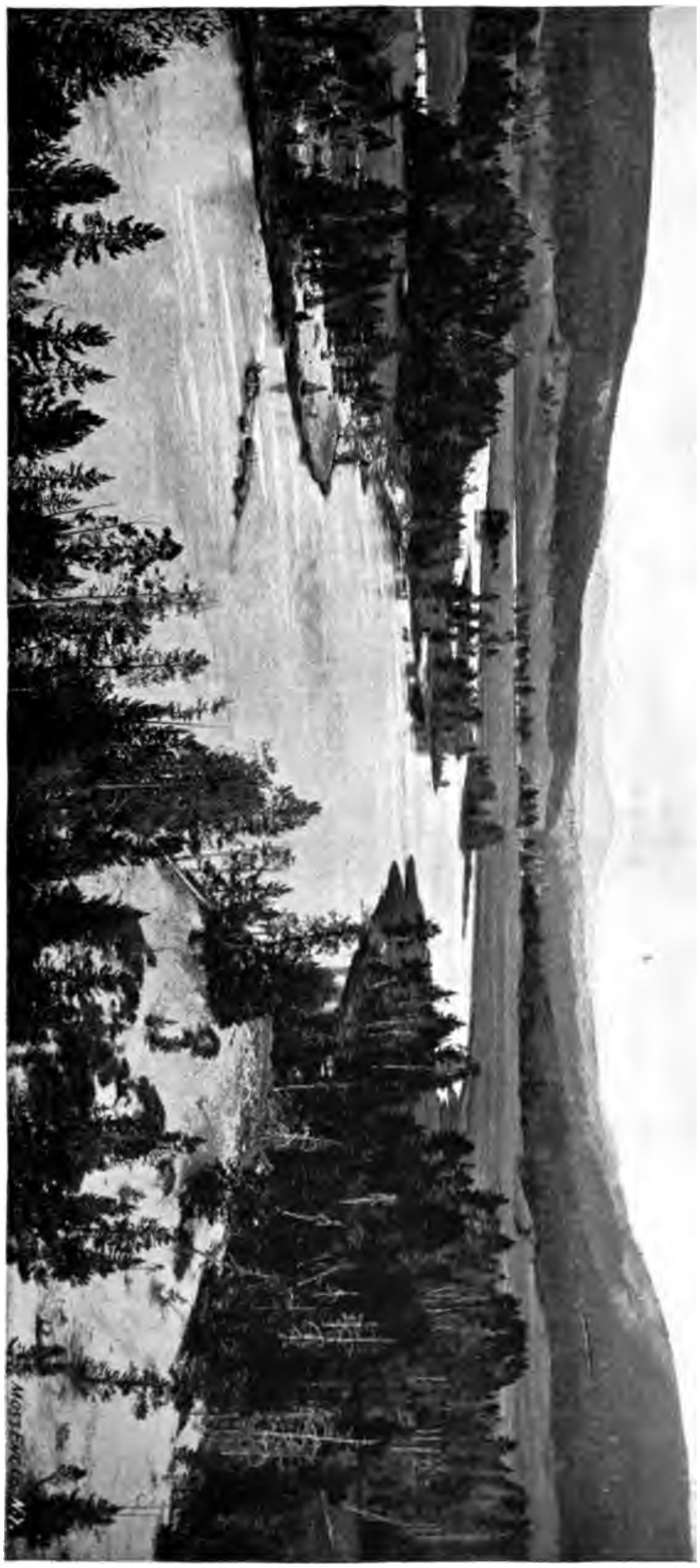
PLATE VIII.

HAYDEN VALLEY.

Bull. U. S. F. C. 1891. Fish-cultural Investigations in Montana and Wyoming. (To face page 60—3.) **PLATE VIII.**

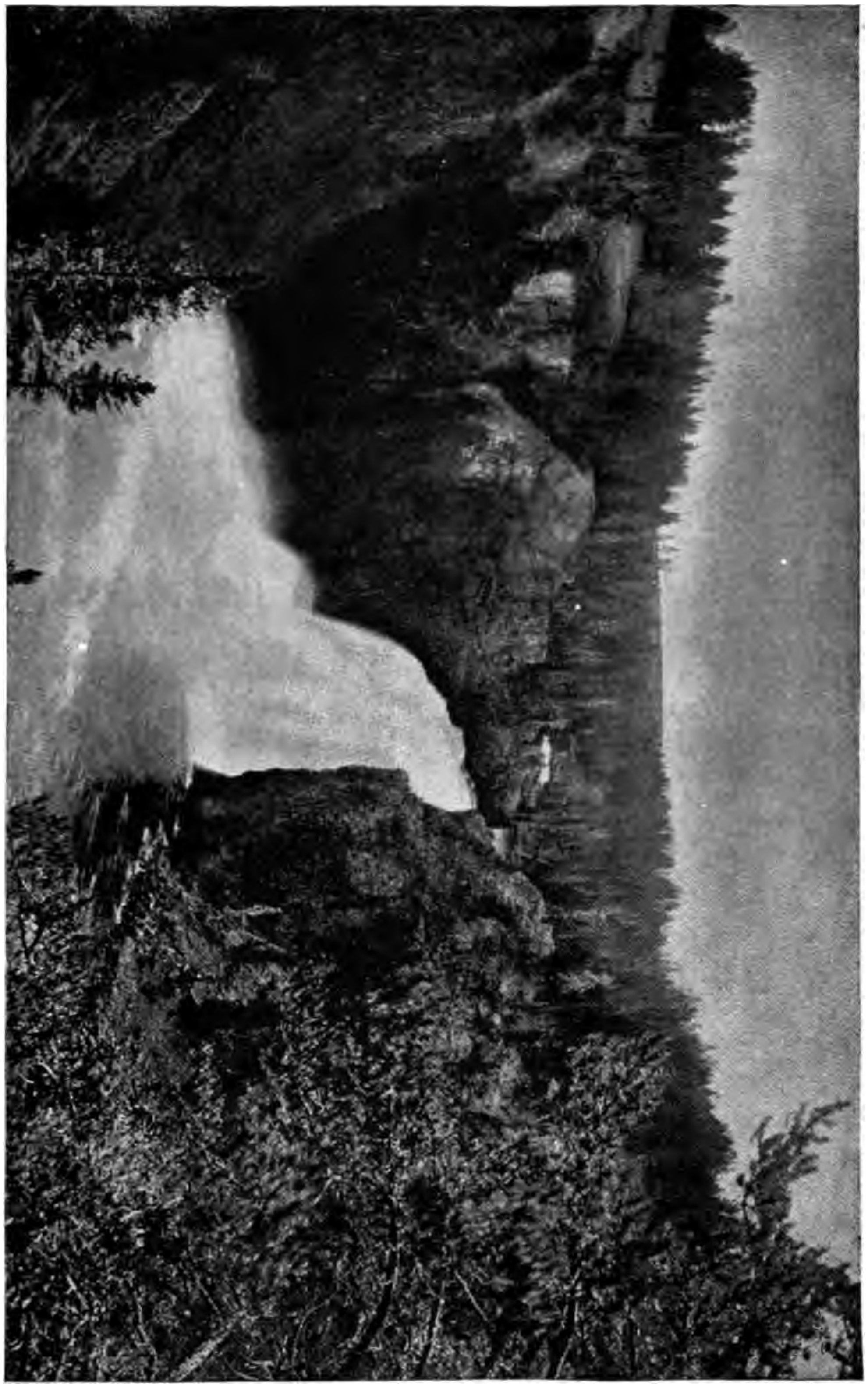


HAYDEN VALLEY.



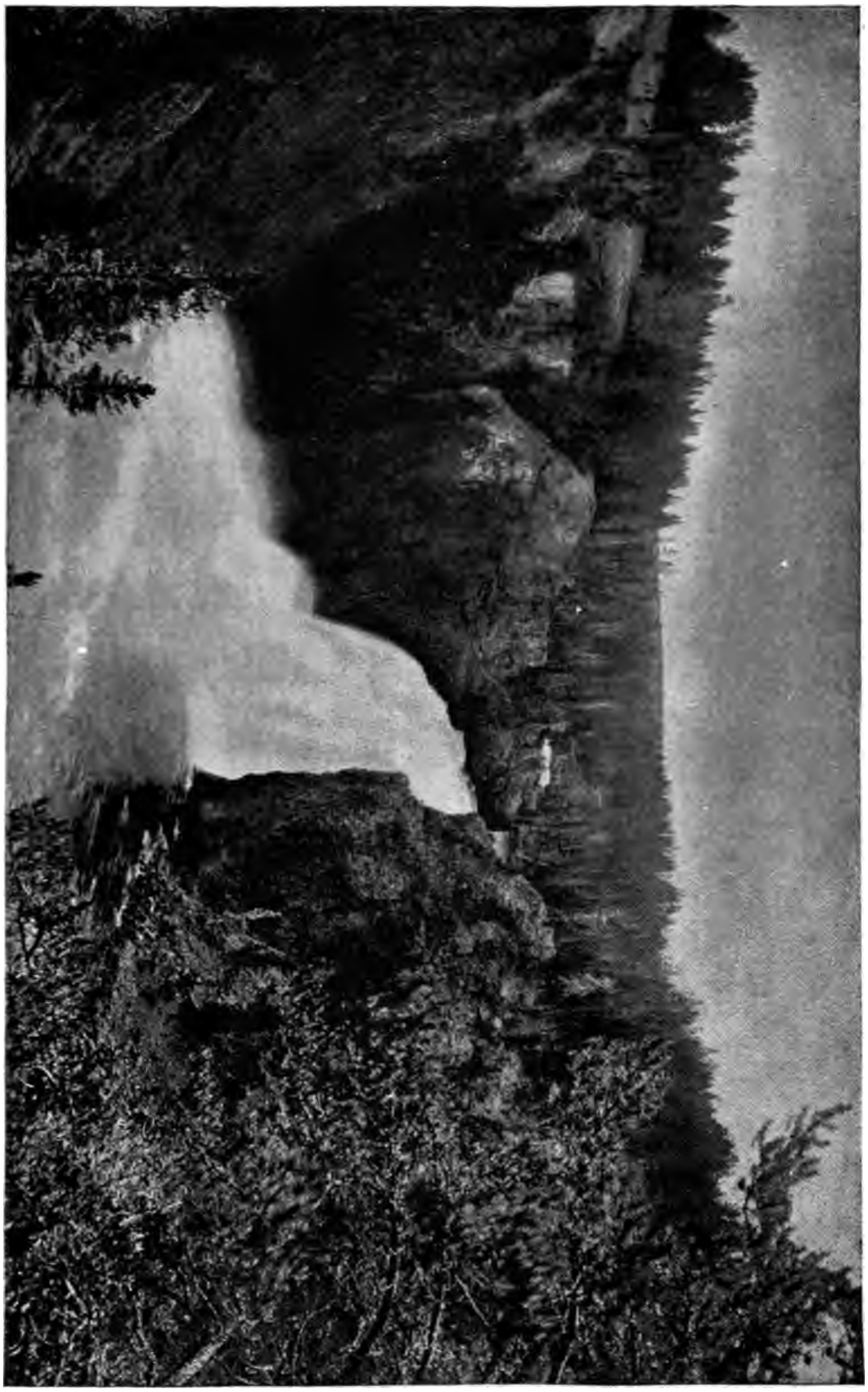
HAYDEN VALLEY.

PLATE X.



UPPER FALLS OF THE YELLOWSTONE RIVER.

PLATE X.



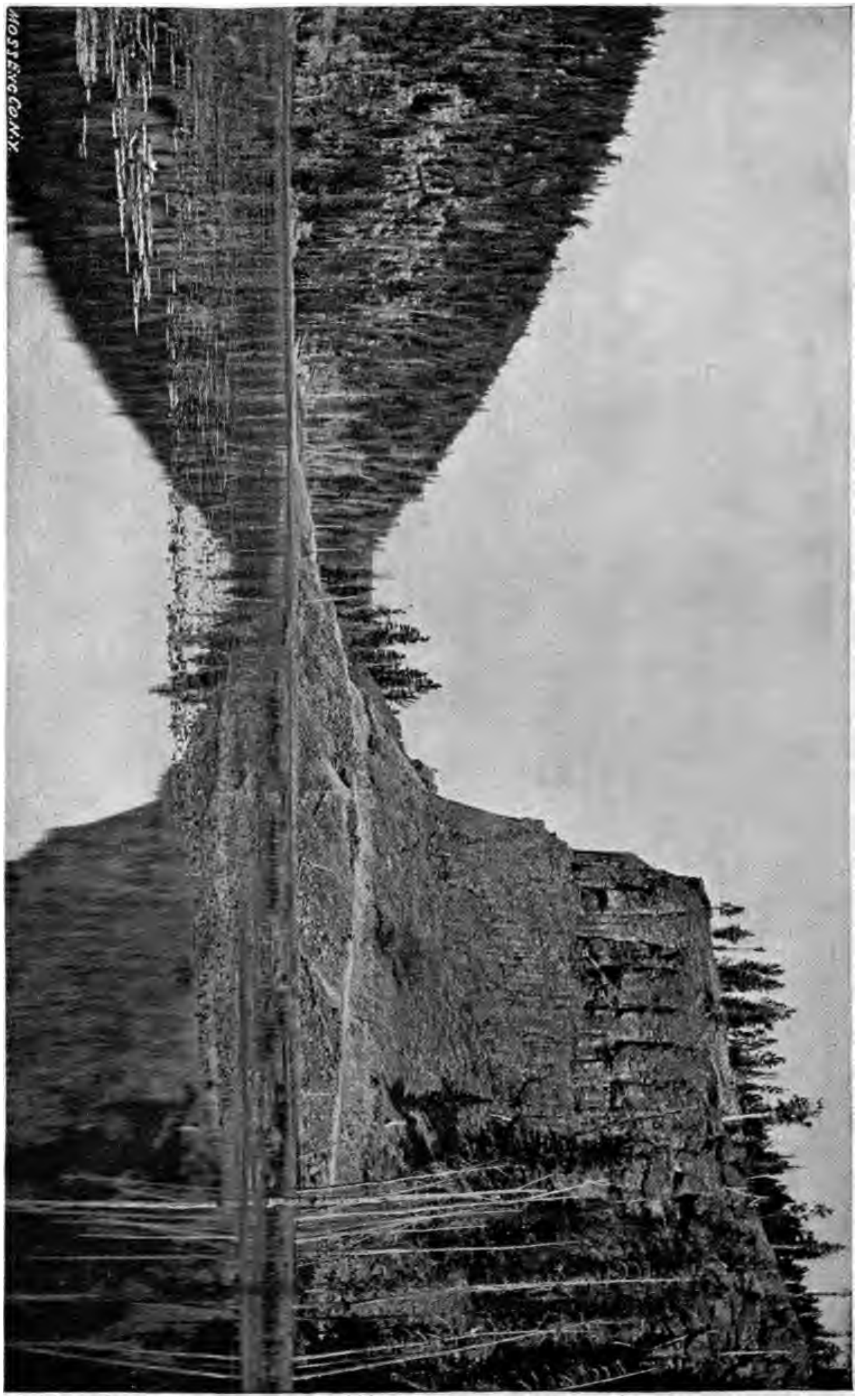
UPPER FALLS OF THE YELLOWSTONE RIVER.

LOWER OR GREAT FALLS OF THE YELLOWSTONE RIVER.

PLATE XII.

GRAND CANYON OF THE YELLOWSTONE, FROM THE BRINK.

PLATE XIII.

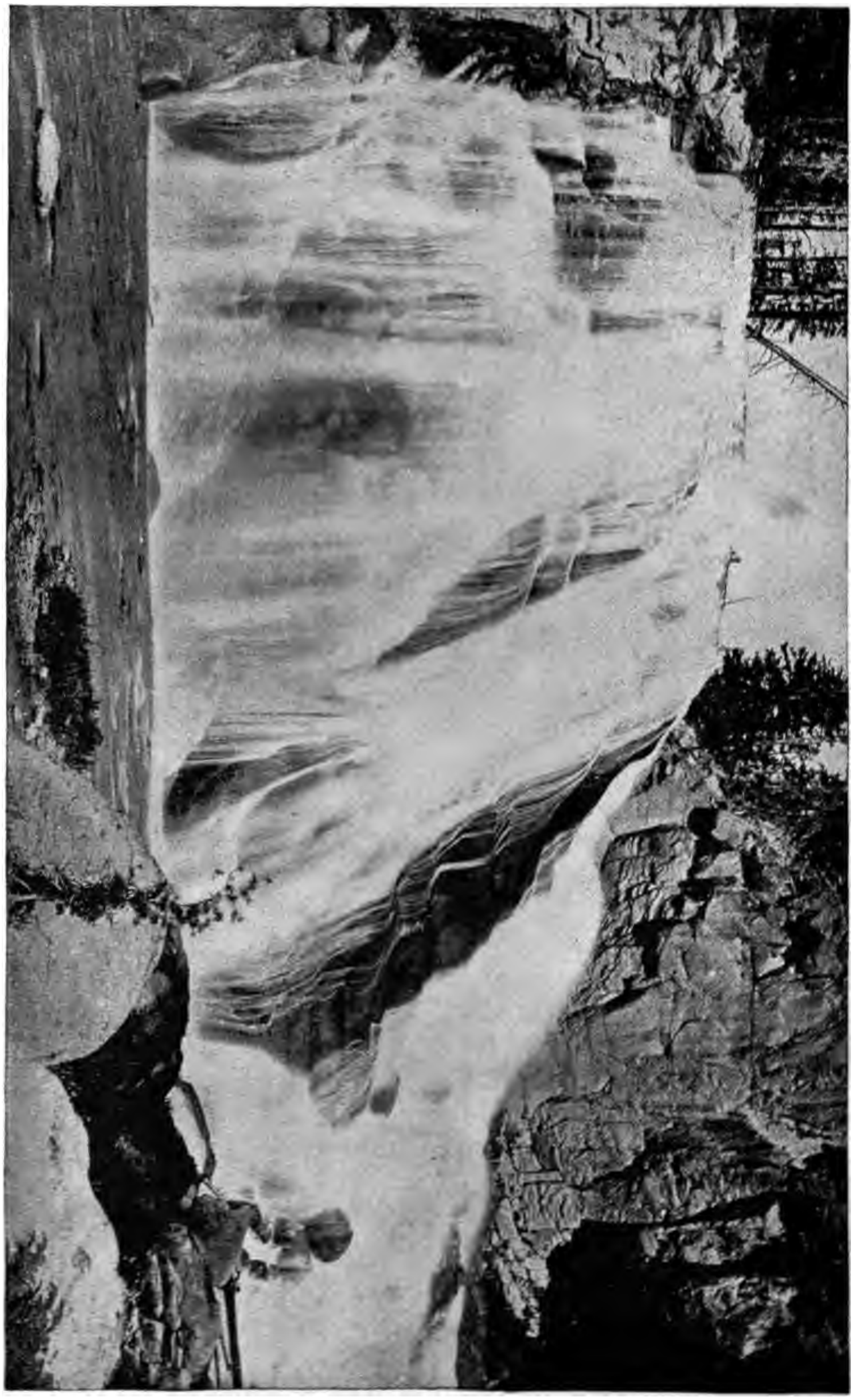


OBSIDIAN CLIFF AND BEAVER LAKE.

PLATE XIV.

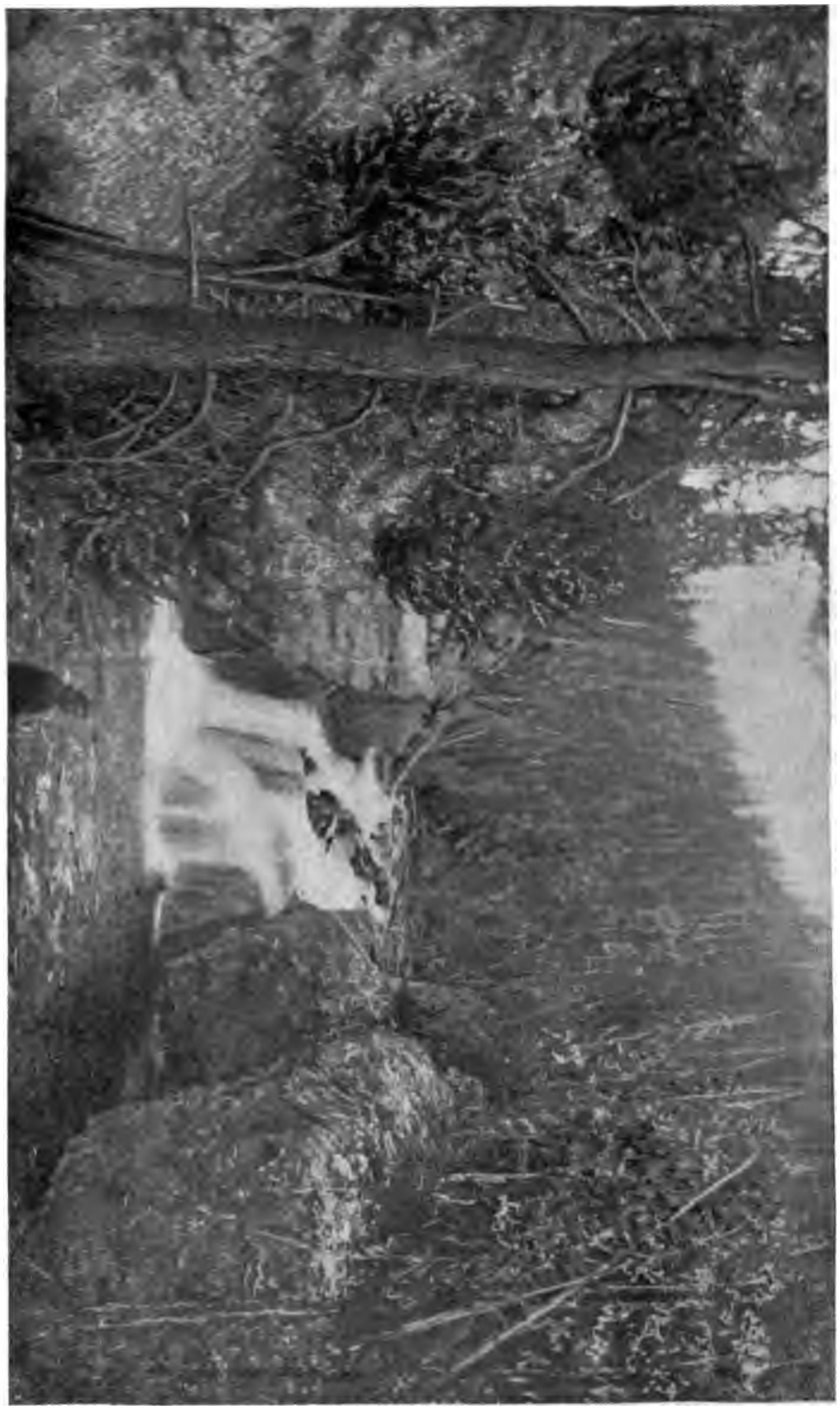
VIRGINIA CASCADE OF GIBBON RIVER.

PLATE XV



GIBBON FALLS OF GIBBON RIVER.

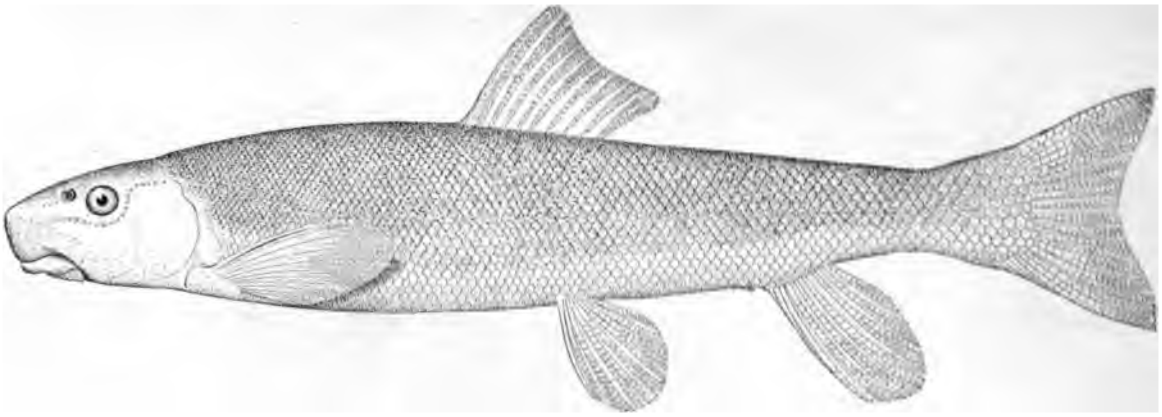
PLATE XVI.



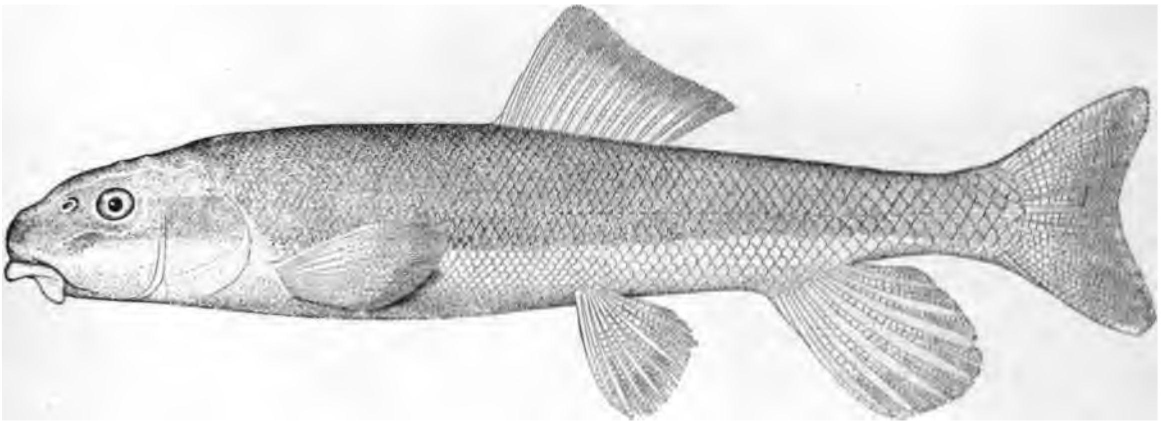
LOWER FALLS OF FIREHOLE RIVER.

KEPPLER CASCADE OF FIREHOLE RIVER.

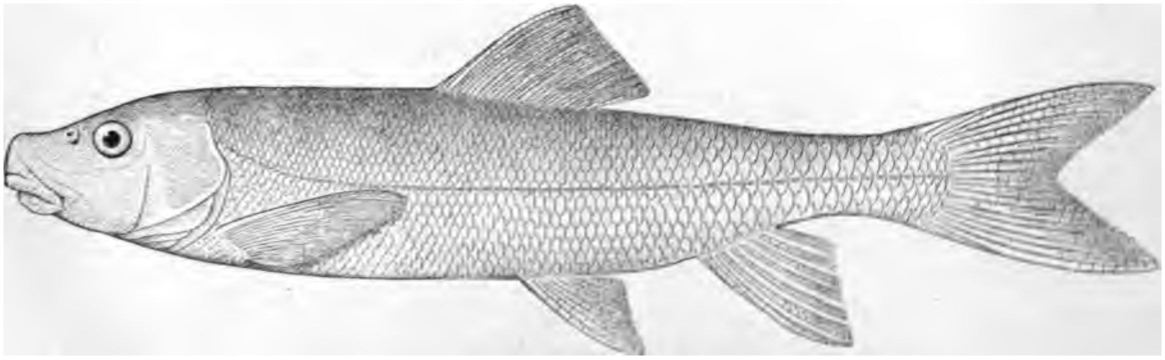
RAPIDS ON LEWIS FORK OF SNAKE RIVER.



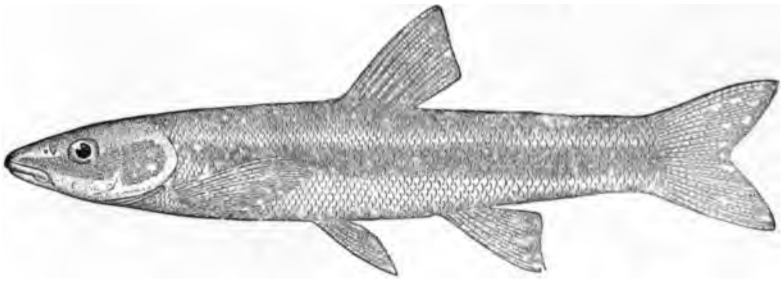
1. CATOSTOMUS DISCOBOLUS Cope. Sucker. About four-fifths natural size.



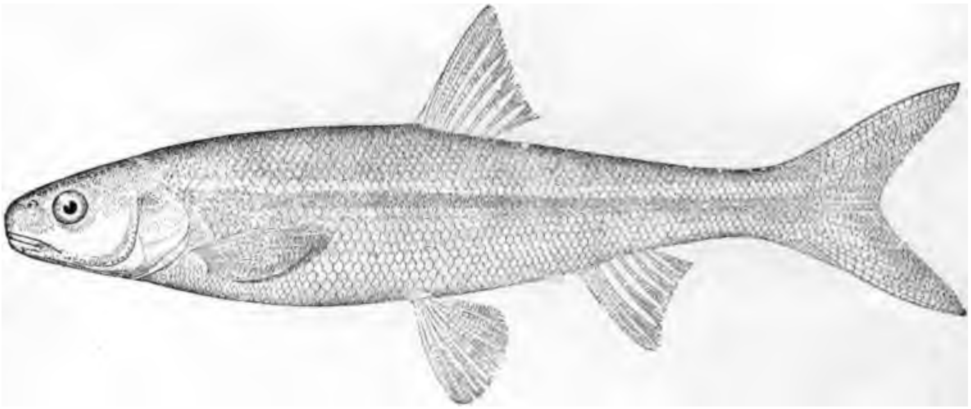
2. CATOSTOMUS MACROCHILUS Grd. About one-half natural size.



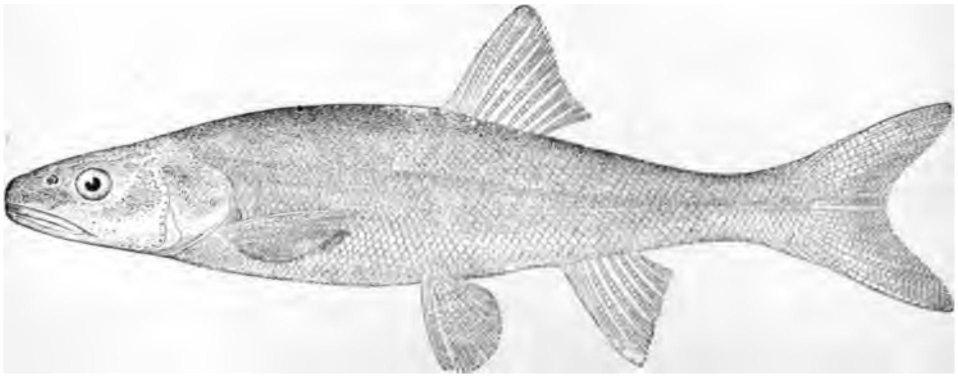
3. CATOSTOMUS ARDENS J. and G. Red-horse Sucker. About one-half natural size.



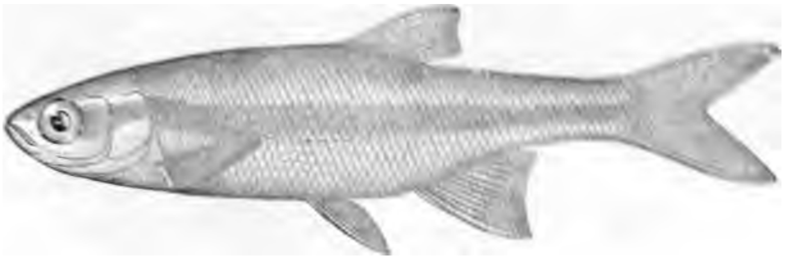
1. RHINICHTHYS DULCIS (Grd.). Dace. About one and one-third times natural size.



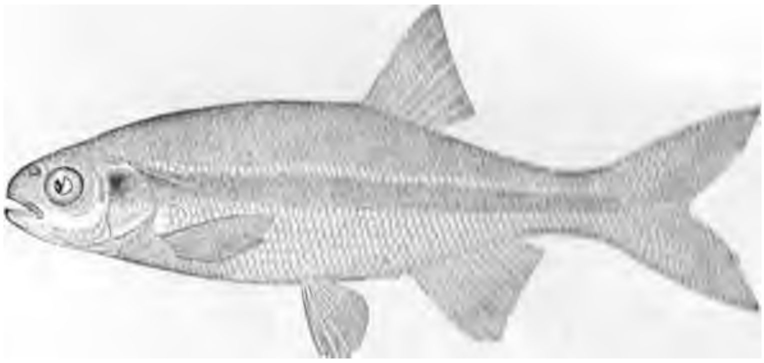
2. MYLOCHEILUS CAURINUS (Rich.). Columbia Chub. About five-eighths natural size.



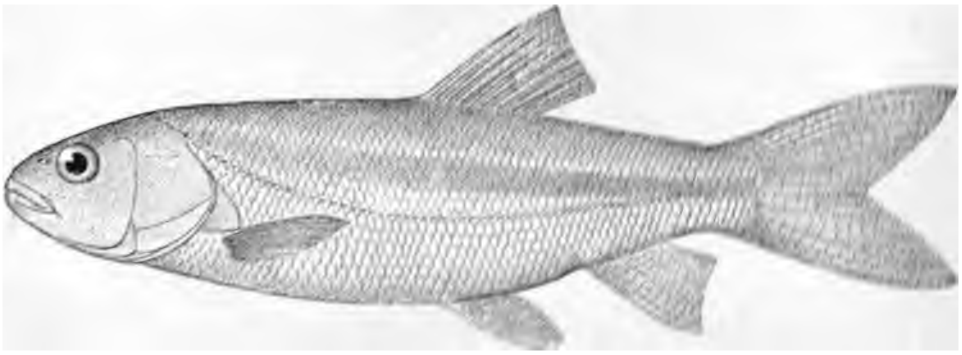
3. PTYCHOCHEILUS OREGONENSIS (Rich.). Squawfish. About one-half natural size.



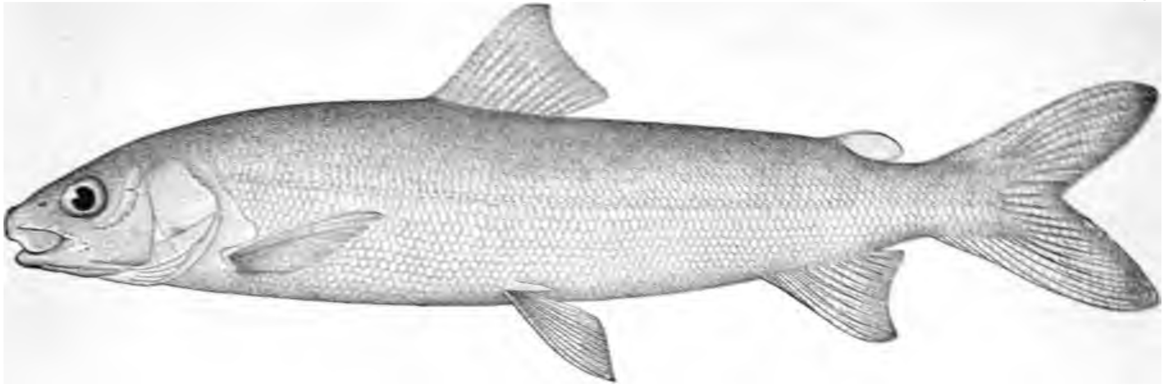
1. LEUCISCUS HYDROPHLOX (Cope). Chub. Natural size.



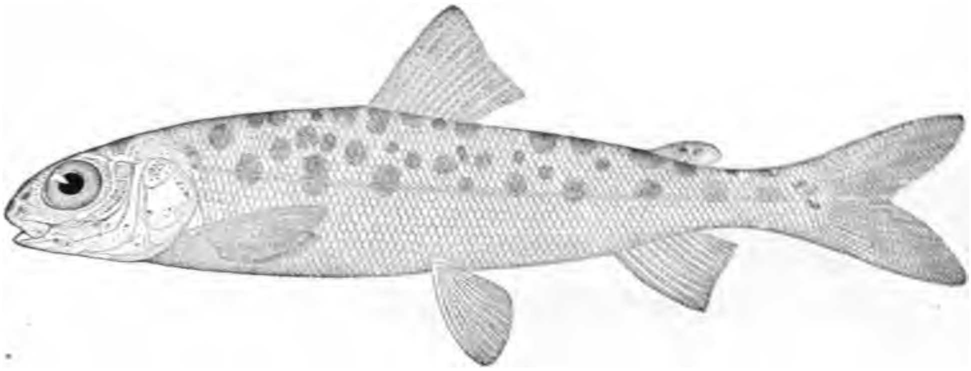
2. LEUCISCUS GILLI, sp. nov. Gill's Chub. Natural size.



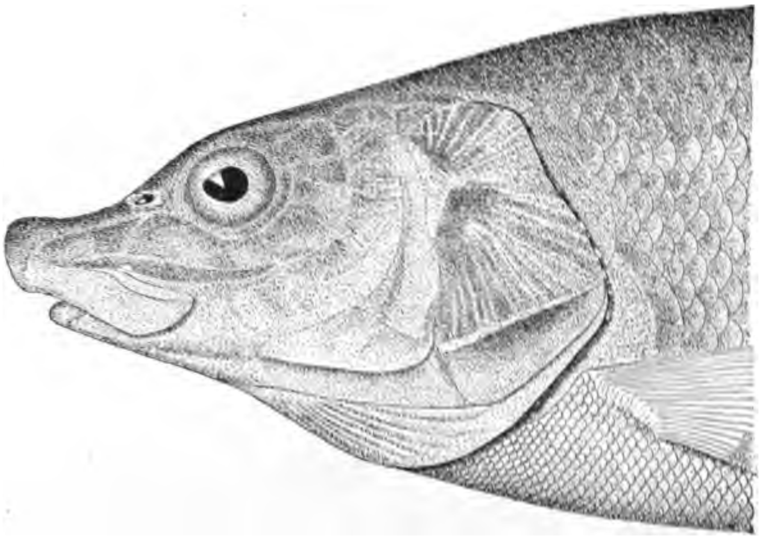
3. LEUCISCUS ATRARIUS (Grd.). Utah Chub. Three-fourths natural size.



1. **COREGONUS WILLIAMSONI** Grd. Williamson's Whitefish. Adult. One-half natural size.

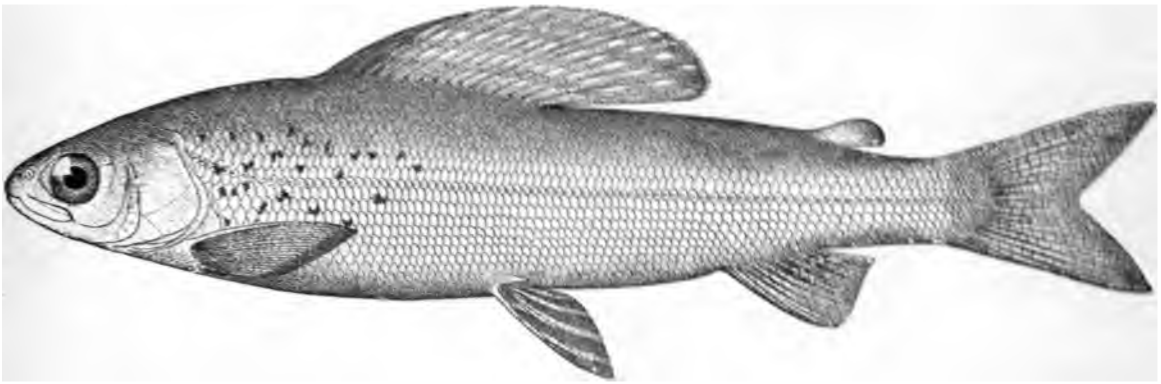


2. **COREGONUS WILLIAMSONI.** Young.

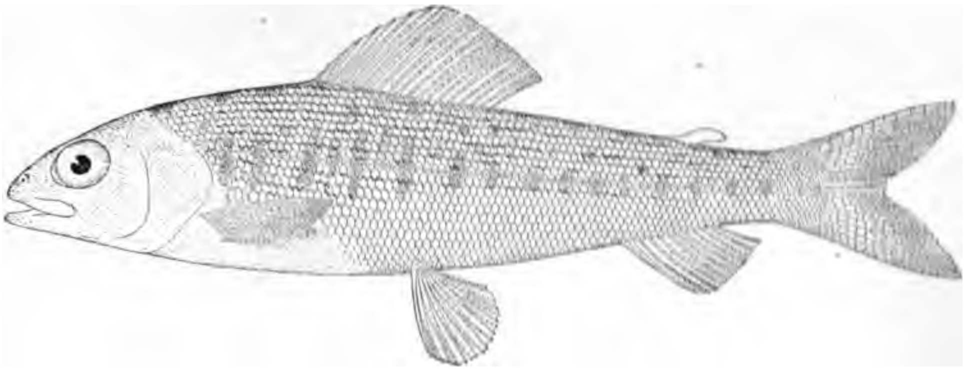


3. **COREGONUS WILLIAMSONI.** Head of breeding male. Natural size.

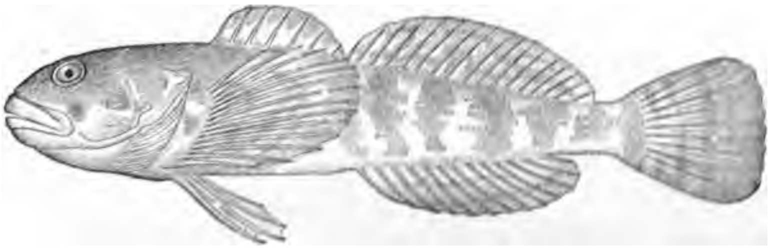
Bull. U. S. F. C. 1891. Fish-cultural Investigations in Montana and Wyoming. (To face page 60—17.) PLATE XXII.



1. THYMALLUS SIGNIFER (Rich.). Grayling. Adult. One-half natural size.

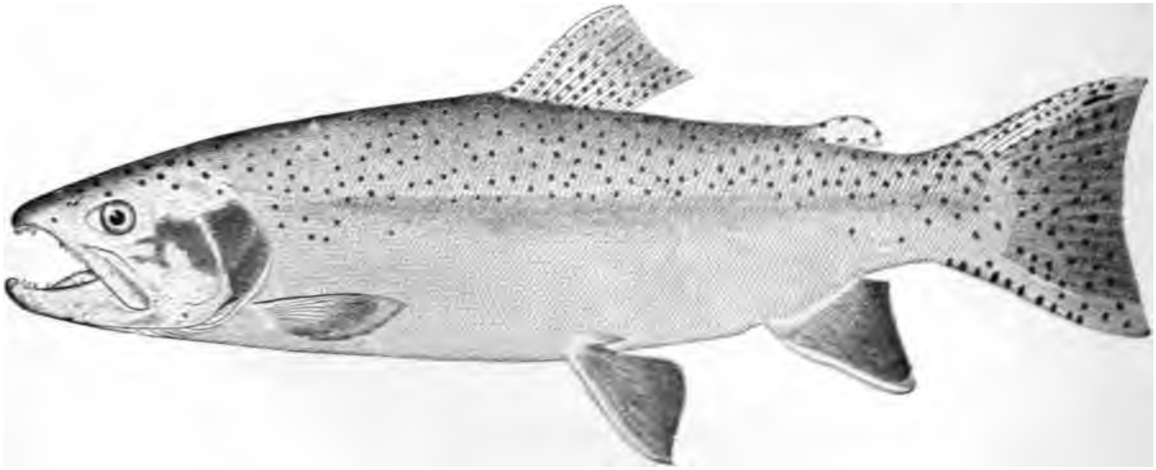


2. THYMALLUS SIGNIFER. Young.

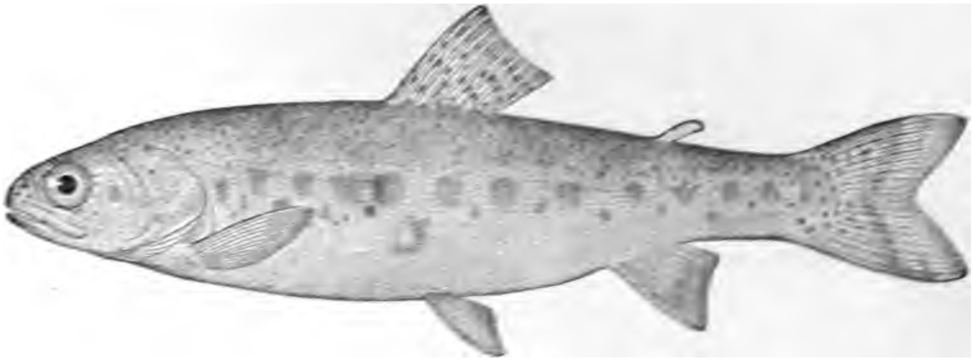


3. COTTUS BAIRDI PUNCTULATUS (Gill). Blob. Two-thirds natural size.

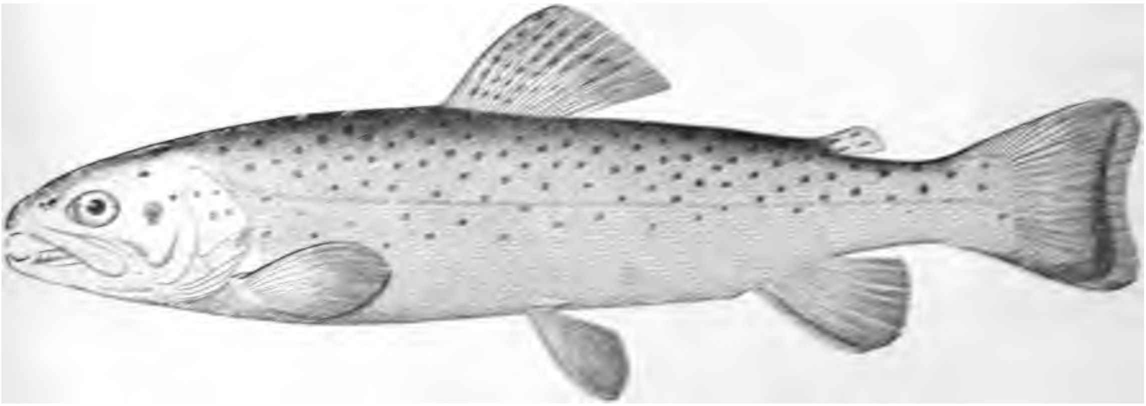
PLATE XXIII.



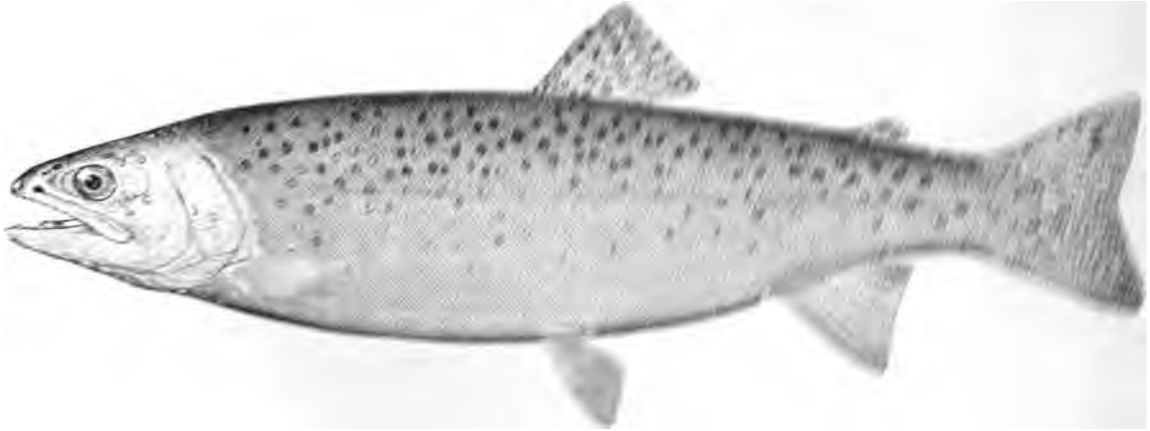
1. SALMO IRIDEUS Ayres. Rainbow Trout. Adult male. Three-tenths natural size.



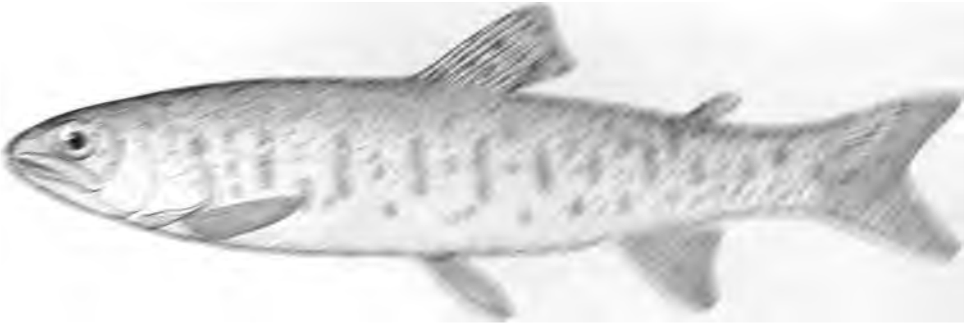
2. SALMO IRIDEUS. Rainbow Trout. Young. Five-eighths natural size.



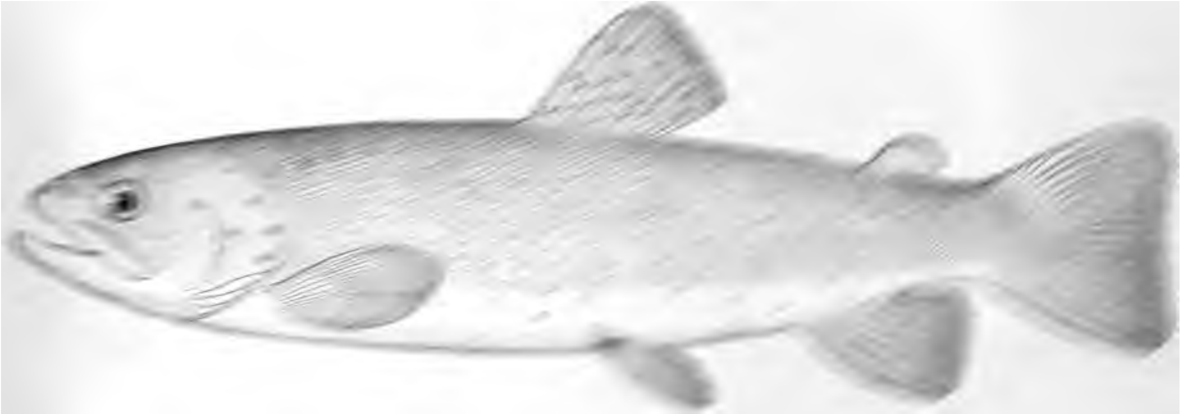
3. SALMO FARIO Linn. Von Behr Trout. One-half natural size.



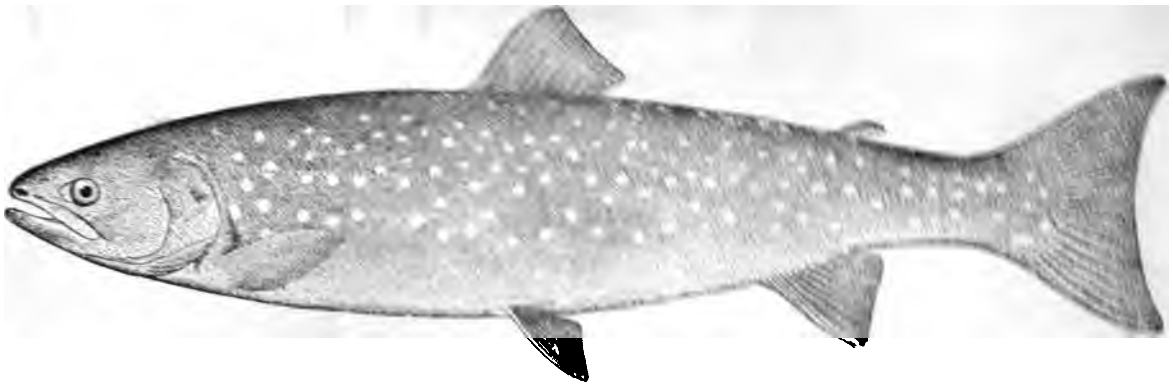
1. Salmo mykiss Walbaum. [illegible]



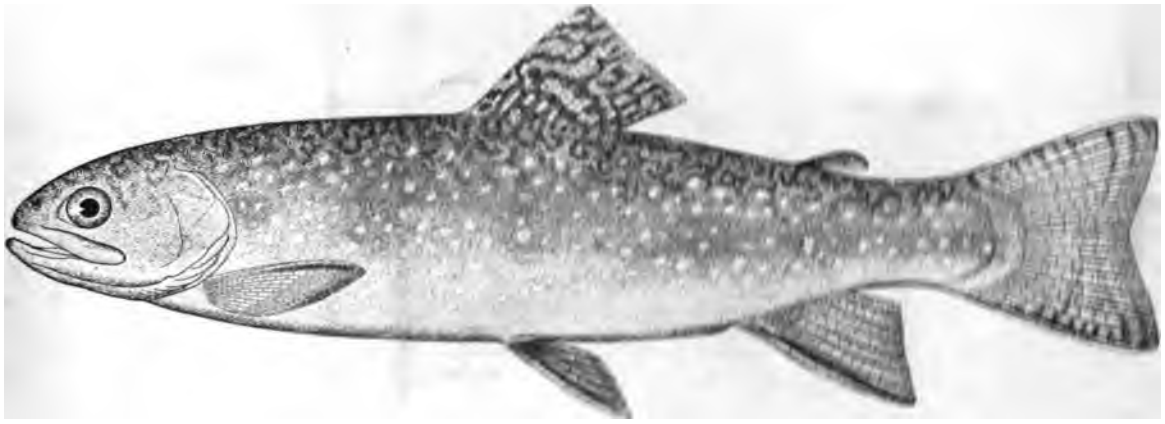
2. [illegible]



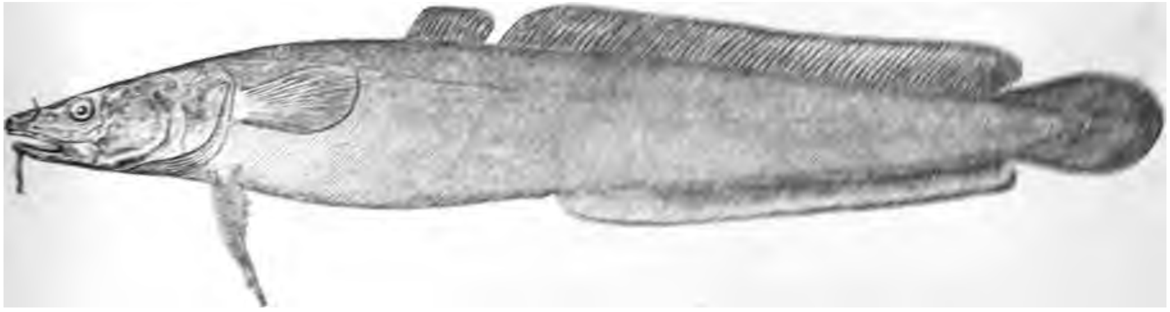
3. [illegible]



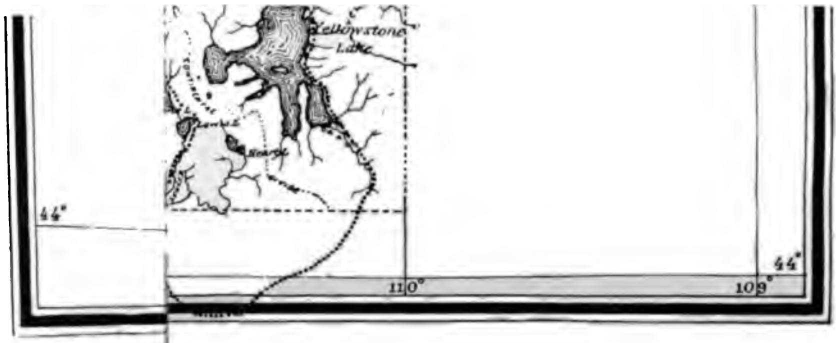
1. SALVELINUS MALMA (Walbaum). Dolly Varden Trout. Two fifths natural size.



2. SALVELINUS FONTINALIS (Mitchill). Brook Trout. Two thirds natural size.



3. LOTA LOTA MACULOSA (Le Sueur). Burbot. Three-tenths natural size.


Yellowstone Lake
Lewis L.
Heart L.
44°
110°
109°
44°

2.—A REPORT UPON INVESTIGATIONS MADE IN TEXAS IN 1891.

BY BARTON W. EVERMANN, PH. D.,
Assistant, U. S. Fish Commission.

This paper is a report upon the investigations made by the U. S. Fish Commission in the State of Texas in November and December, 1891, as contemplated in an act of Congress, approved March 3, 1891, providing "For investigating respecting the advisability of establishing a fish-hatchery station in the Rocky Mountain region in the State of Montana or Wyoming, and also in the Gulf States."

The character of the station which it is desired to establish in this region is indicated in the memorandum of instructions furnished me by Col. Marshall McDonald, the Commissioner of Fish and Fisheries, viz:

> It is desirable, if practicable, to unite in one station the facilities for fish-cultural work with the salt-water species, for the pond culture of fresh-water species, for the investigation and development of methods for the propagation and rearing of the oyster, and for the investigation of the marine life of this coast. This means, of course, a laboratory of marine biological research, not large or expensive, but thoroughly equipped in all respects for its work. It is not necessary that all these requirements should be found at one locality, but they should be so closely and conveniently associated as to be brought under one direction. The requirements for each of the above classes of work may be briefly indicated as follows: For marine research and for hatching there will be required a suitable site above the chance of damage by storm or tide, with available supply of salt water. For the study of methods of oyster-culture will be needed an area of 100 to 200 acres of low-lying marsh lands, on the coast line, easily convertible into storage and rearing ponds. If this lies on the banks of a landlocked bay, from which the salt water may be conducted by canals into the ponds and which is not subject to roiling by storms, this is of course desirable.

If the requisite conditions for such a composite station could not be found sufficiently closely associated, I was instructed to make investigations in the interior of the State looking toward the selection of a site suitable for the culture of fresh-water species alone.

The requirements for the culture of fresh-water species of fish for this region are, briefly:

1. A constant supply of about 1,000 gallons of pure water per minute.
2. Not less than 20 to 30 acres of land. This land should lie so that the water may be obtained from the source of supply by means of gravity if possible. The land should be of such a character as to render the construction of ponds upon it an easy matter, and the fall should be sufficient to permit the ready drainage of any one of the series of ponds whenever occasion requires. Furthermore, there should be no danger of contamination from freshets or other causes.
3. The location should afford good railroad facilities.

The determination of the abundance, condition, and definite range of each and every species of fish and the character and abundance of their food supply is a question not only of great scientific interest but one of the utmost economic importance in its bearing upon the intelligent and successful propagation of useful food-fishes. The physical, chemic, and biotic forces which go together to constitute the fish environment of any given stream must be clearly understood before that stream can be intelligently stocked with any additional species. These forces may be so adjusted as to render the introduction of the proposed species fatal to one or more kinds of valued food-fishes already found in the stream; or, on the other hand, the great abundance of some indigenous species of carnivorous fish might render it impossible for the species which it is proposed to introduce to ever become well established.

In carrying out my instructions visits were made to Galveston and Corpus Christi, on the coast, and Houston, Palestine, San Antonio, New Braunfels, San Marcos, Austin, and Fort Worth, in the interior. It is believed that the investigations at Galveston and Corpus Christi are sufficient to determine whether the coast affords any suitable location or not, and so many excellent locations for a fresh-water station were found in the interior as to render further explorations unnecessary.

On the whole, it may be said that no point on the coast examined offers entirely satisfactory conditions for the establishment of a combined fresh and salt water station, but the Swan Lake site, near Galveston, might prove fairly suitable.

It was intended to make a careful study of the Trinity River Basin, giving attention to the various streams in this drainage area; the nature and volume of the water of each; the general character of the vegetation, both in the streams and along the banks; the geologic features of the country; the character and abundance of the fish found in each stream, and the presence of crustacean and other life in the waters which may serve as food for fishes. While some work of this character was done on the Trinity River, inclement weather necessitated the deferment of its completion.

Temperatures were taken with a Wilder's standard thermometer and are given in Fahrenheit degrees. The seining was done with Baird collecting seines of small size, except at Galveston and Corpus Christi, where we availed ourselves of the services and larger nets of the local fishermen.

ACKNOWLEDGMENTS.

I desire to make mention of the many courtesies shown us by the citizens of the various places visited by us. At Galveston we were assisted greatly in our work by the kind and thoughtful attention of many of the most prominent citizens of that place, among whom I should mention especially Mr. Fred. McC. Nichols, Mr. F. L. Dana, the secretary of the board of trade, and Mr. Julius Runge, president of the Galveston Packing Company. Through the kindness and hospitality of Mr. Nichols, we were enabled to visit several of the artesian wells on the mainland and to make a careful exploration of Dickinson Bayou.

At Houston our party received many courtesies from Maj. M. Looscan, Maj. A. C. Herndon, and Mr. Geo. A. Bringhurst, all of the board of trade, and from Messrs. Robert E. C. and Harvey T. D. Wilson. Through the kindness of these gentlemen we were enabled to make very careful investigations in Harris County.

At San Antonio we were assisted in visiting the springs by Mr. Joseph Hettler,

park commissioner of that city. At Austin, Mayor John McDonald, Mr. J. B. Lubbock, ex-State fish commissioner, and other gentlemen extended us facilities which aided us materially in our investigations there. We are also indebted to Mr. John A. Grant, third vice-president and general manager of the Texas and Pacific Railroad, and to officials of the International and Great Northern Railroad, for various favors.

ITINERARY.

I left Washington, District of Columbia, October 25, and proceeded to Neosho, Missouri, where I was met by the Commissioner, Hon. Marshall McDonald, and Dr. J. T. Scovell, of Terre Haute, Indiana. After spending three days, acquainting ourselves with the workings of the Government fish-hatchery at Neosho, we proceeded to Galveston, Texas, where we arrived November 2. The Commissioner left for Washington on November 4, and on the same day we were joined by Dr. R. R. Gurley, of the U. S. Fish Commission. We remained at Galveston and vicinity until November 15, when we went to Houston. On November 16 and 17 we examined Buffalo Bayou at various places, and Big White Oak Bayou near the city. On the 18th we drove to Sims Bayou, and the next day we went by rail and wagon to Clear Lake, near Websterville. On November 22 we went to Palestine, and during the next three days examined Trinity River, Long Lake, and Neches River, in that vicinity. We were joined here by Mr. J. A. Singley, of the Texas State Geological Survey, he having been directed by the State geologist, Dr. E. T. Dumble, to accompany us for the purpose of studying the molluscous fauna of the State. On November 26 we went to Corpus Christi, where we remained until December 1, upon which date we went to San Antonio. Remaining one day at San Antonio, we next visited New Braunfels, San Marcos, and Austin, spending one day at each place. From Austin we went to Fort Worth on December 6, where we remained one day. Owing to the unusually cold and disagreeable weather it was thought advisable to close the work here.

WATERS EXAMINED.

The following is a classified list of the waters examined:

I. *Galveston Bay:*
  1. Highland Bayou.
  2. Dickinson Bayou.
  3. Swan Lake.
  4. Clear Lake and Creek.
  5. Buffalo Bayou.
    (*a*) Sims Bayou.
    (*b*) Big White Oak Bayou.
    (*c*) Hunter Creek.
    (*d*) Kilper's Ponds.
  6. San Jacinto River.
  7. Trinity River.
    (*a*) Long Lake.

II. *Neches River.*

III. *Corpus Christi Bay:*
  1. Nueces River.

IV. *San Antonio River:*
  1. San Antonio Springs.
  2. San Pedro Springs.

V. *Guadalupe River:*
  1. Comal Springs.
  2. Comal Creek.
  3. San Marcos Springs.
  4. San Marcos River.
  5. Rio Blanco.

VI. *Colorado River:*
  1. Barton Spring.
  2. Barton Creek.

REPORT OF THE INVESTIGATIONS.

GALVESTON BAY.

Investigations were made at various places in the vicinity of Galveston for the purpose of determining whether the conditions necessary for the culture of fresh-water fishes, salt-water fishes, and cysters could be found combined in one place. This, of course, means a location on or near the bay where salt water can be gotten under control and where fresh water can also be obtained. With this object in view visits were made to Dickinson, Fairwood, Hitchcock, and Highland, all on the mainland across the West Bay from Galveston; to Swan Lake and Moses Lake, on the mainland northwest of Galveston; and to South Galveston on the island.

FRESH WATER.

The only possibility of obtaining fresh water at any of these places is by means of artesian wells. There are not fewer than sixteen artesian wells on the mainland in the vicinity of Dickinson, Highland, Hitchcock, and Fairwood. The deepest of these is 768 feet, and the most shallow about 80 feet.

One well at the Ramie experimental farm on the Nicholstone estate, having a 2-inch strainer, flows 40 gallons per minute. The temperature of the water is 78°.

Another well near Dickinson flows about 25 gallons per minute; temperature, 78°.

At Fairwood is a well 576 feet deep, with a 2-inch strainer, which flows not less than 52 gallons per minute. The temperature is 78.5°. No analysis of this water has been made, but it is palatable and seems approximately pure. There is some carbureted hydrogen and a trace of iron.

Judge Wheeler's well, near Hitchcock, is 768 feet deep, has a 2-inch strainer, and flows about 48 gallons per minute. The temperature is 78°.

The Tacquard well, near Hitchcock, is 710 feet deep, has a 2-inch strainer, and flows 100 gallons per minute. The temperature is 79°. The height to which the water will rise above the surface at this well was found to be about 20 feet.

The Gulf, Colorado and Santa Fé well at Hitchcock is 726 feet deep. It has a 5-inch strainer, 30 feet long, and flows 97,000 gallons per day, or 67 gallons per minute. An analysis made April 23, 1890, by W. D. Church, chemist for the Atchison, Topeka and Santa Fé Railroad, Topeka, gave the following results:

Organic matter	Trace.
Silica	.350
Alumina and oxide of iron	.250
Bicarbonate of calcium	3.499
Bicarbonate of magnesium	1.500
Bicarbonate of potassium and sodium	17.221
Sodium chloride	9.660
Total solids (grains) per United States gallon	32.480

The temperature at outlet of pipe was 79°; density, at 15° C., 1001.91.

The South Galveston well is 800 feet deep, and has a 3-inch pipe with a 2-inch strainer. It flows 37 gallons per minute, and the temperature of the water as it comes from the pipe is 79.5°. The density at this temperature was 1002, which, reduced to 15° C., gives 1004.24.

At Judge Wheeler's residence, near Hitchcock, a fish pond has been made which receives its water supply from the artesian well. Black bass and sunfish have been placed in this pond, where they seem to thrive very well. The water of the Wheeler well does not seem to differ materially from that of the other wells of this vicinity, and it is probable that such species of fresh-water fishes as would be cultivated at the station contemplated would do fairly well in ponds supplied from any of these wells.

I understand that water has been gotten in every place on the mainland where wells have been bored, so it is quite certain that water of this character could be obtained along the mainland in the vicinity of the bay. To obtain the requisite supply would probably require three or four wells sunk to a depth of over 700 feet, and each should have at least a 3-inch strainer.

SALT WATER.

Galveston Bay is shut off from the Gulf by Bolivar Peninsula and Galveston Island, between which is the Bolivar Channel. This channel is about 2 miles wide and is the entrance to the bay. The greatest length of the bay is from northeast to southwest, and is approximately 35 miles. The width between Bolivar Point and Swan Lake is about 7 miles. Above these points the bay widens out greatly, sending an arm known as East Bay to the eastward. Including East Bay, it is here not less than 27 miles wide. Above this it constricts again between Edwards and Smith Points, where it is less than 8 miles wide. Above Redfish Bar, lying between Edwards and Smith Points, is really the main part of the bay, the greatest width of which is about 14 miles, on a line running northwest from Smith Point to Morgan Point at San Jacinto Bay. Extending westward from the east end of Galveston Island, and separating it from the mainland, is West Bay. At the northeast end of the bay is a small bay known as Turtle Bay, shut off from the main bay by the delta of the Trinity River. At the northwest corner, lying above Morgan Point, is San Jacinto Bay, into which the San Jacinto River and Buffalo Bayou empty. About 10 miles down the west shore is the mouth of Clear Creek, the outlet of Clear Lake. Seven miles farther down is the mouth of Dickinson Bayou, just below which is Moses Lake; and 5 miles below this, or about 6 miles northwest from Galveston, is Swan Lake. Just north of Galveston, and between Swan Lake and Bolivar Point, are Pelican Spit and Pelican Island.

Through the greater part of the bay the depth of water is given as from 1 foot to 11 fathoms. According to the U. S. Coast Survey Chart (No. 204) of Galveston Bay—

> There is usually one high and one low water here in each lunar day. The highest tides occur when the moon's declination is greatest, either north or south, and they are slightly increased when the greatest declination falls near the time of new or full moon. When the moon's declination is near zero, small tides usually appear twice a day for two or three days. The following table is made from average values:

Place.	Rise and fall of tides.		
	Mean.	At moon's greatest declination.	At moon's zero declination.
	Feet.	*Feet.*	*Feet.*
Galveston entrance	1.1	1.6	0.8
Pelican Spit	1.1		
Redfish Bar	0.5		

It is high water about seven or eight hours after the moon's meridian passage when the moon's declination is greatest south, and nearly twenty hours after when it is greatest north; but these intervals are uncertain by several hours. The effects of the winds are often greater than the real tides, and the time and the height of the apparent tides are greatly dependent on them.

The waters of Galveston Bay seem well adapted to the oyster. Oysters of good size and quality were seen about the wharves at Galveston, at Swan Lake, Moses Lake, Dickinson Bayou, Virginia Point, and other places.

The Galveston Packing Company was organized two or three years ago at Galveston for the purpose of developing the oyster industry at that place. This company has located 6,000 acres in the bay, principally in the vicinity of Pelican Island, of which they have planted 440 acres. Three thousand bushels of shells were planted upon one tract of 10 acres. Upon these shells a good set was obtained. These oysters were about eighteen months old at the time of our visit, and were very abundant and of excellent quality.

The density of the water here was 1021.66;* the temperature at surface, 72.5°, November 9, at noon.

Just off the outlet of Swan Lake the density was 1018.30; temperature at the surface at 10 a. m., November 10, 62°. Just inside of Swan Lake the density was 1017.30. Swan Lake is a shallow body of salt water, covering 600 or 700 acres. It has two outlets into the bay, one about 100 feet wide, the other about half as wide. Between these two narrow outlets is a low mud island which no doubt is flooded frequently at high tide. Oysters are quite abundant in this little lake, and we noticed two or three boats tonging oysters here. I paid special attention to this lake, as it seemed to present many of the conditions required for the station under consideration.

Swan Lake is quite shallow and, according to Mr. Parr, who lives upon the shore, is rapidly filling up. He says the lake is less than half as large as it was eighty years ago, when his father first settled upon it, and that it has decreased much in size during the last forty years, or within his own memory. The shores are, in the main, very low, particularly at the north end and on the east and southeast, where they are marshy. At the north end one or two small creeks flow into the lake, but I do not imagine the amount of water they carry in can be very great. At Mr. Parr's place, on the west side of the lake near the south end, the shore is several feet high, and apparently never subject to overflow. The greater part of the shore, however, is certainly flooded occasionally.

The low-lying land just north of Mr. Parr's, near the upper end of the west side of the lake, could be easily converted into ponds suitable for the study of methods of oyster-culture. Whether the water often becomes roiled I was not able to learn, nor do I know how injurious occasional flooding of the ponds would prove. Flood-gates could be constructed at the outlet of the lake by means of which the water coming in with the tide could be stored and fed out to the ponds between tides.

The tide is so little at this place that it could scarcely be depended upon for giving a gravity supply, consequently pumping would have to be resorted to. It is probable that water for the fresh-water ponds could be obtained by sinking artesian wells. These ponds could be constructed on the higher land near the south end of the lake.

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*The density, as given in this report, is that of the water reduced to 15° C.

This location is about 3 miles from the railroad station at Virginia Point. It would seem to me that such a composite station as is contemplated could, with reasonable safety, be established in the vicinity of Swan Lake. The cost of getting sufficient water, salt and fresh, the doubt as to whether the artesian water would prove satisfactory, and the danger of flooding and roiling from storms, are questions that would have to be carefully considered.

The country in the vicinity of Moses Lake, Clear Creek, and Highland Bayou was also examined, but in no one of these places could the desired conditions be found, the danger of fresh-water flooding in each case being too great.

A visit was also made to South Galveston, on the island 10 miles southwest from the city of Galveston. At this point the South Galveston Land Company has recently struck water that seems fairly fresh. The depth of the well is 800 feet. With a 2-inch strainer the flow is 37 gallons per minute. The temperature of the water was 79.5°, and the density was 1004.24.

There is but little, if any, saline taste to the water, and it might prove suited to fresh-water fishes. There is considerable gas (probably CH_4) dissolved in this water, as was evidenced by the fact that a slight explosion was obtained upon applying a burning match at the end of the horizontal pipe through which the water was led from the well. Upon issuing from the pipe the water is quite murky, but very soon clears by the escaping of the contained gas or gases.

On the West Bay side of the island, a short distance from this well, are two narrow bays extending obliquely into the island. Each of these contains approximately 40 acres. The land adjacent to each is low, but probably high enough to prevent flooding, except during very heavy storms. Either of these small bays could be quite easily supplied with gates at the mouth and its water thus brought under control. Ponds could be constructed near them that would probably answer fairly well for oyster-culture. Higher ground can be found near by, suitable for the fresh-water ponds. Mr. Gray, the president of the South Galveston Land Company, says the company will give the Commission one of these bays and all the land it may need. This location does not seem as desirable, however, as the one at Swan Lake—the land not lying so satisfactorily and the water being less fresh than that which could probably be gotten at Swan Lake.

Mr. Fred Nichols offers a site near the mouth of Dickinson Bayou. The land there seems safe from overflow, and salt water could be gotten by pumping from the bayou. It is quite certain, however, that this bayou at times becomes too fresh for salt-water culture. Fresh water could be secured here, as elsewhere upon the mainland, by means of artesian wells. Mr. Nichols would no doubt donate all the land needed.

Dickinson Bayou.—This bayou is about 18 miles long and empties into Galveston Bay about 15 miles north of Galveston. In its lower portion its waters are salt except at the time of heavy rains, and the water is more or less brackish nearly throughout the course of the stream. The depth probably ranges from 4 to 18 feet. The water is rather warm and is stained more or less by vegetable matter in the stream. The current is sluggish and the banks and bottom are of mud in most places. The shores are low and are well covered with vegetation. There is a heavy growth of timber, the principal trees being several species of oak, elm, hackberry, ash, box elder, etc. The most characteristic and striking feature of the timber along Dickinson Bayou is the long moss (*Tillandsia usneoides*), which covers nearly every tree. In the immediate vicinity of Nicholstone the large oaks are magnificent with the long festoons of this interesting epiphyte. A number of small creeks or brooks flow into this bayou, but they are usually quite narrow and not deep. At the time of our visit they were nearly dry except here and there where were found pools 1 to 4 feet deep, filled with stagnant, bad-smelling water. These pools have muddy bottoms and are full of logs and snags.

In the lower part of the bayou are found many of the salt-water fishes of the bay together with oysters, shrimps, and many other salt or brackish water forms. In the upper portion were species of several genera of fresh-water fishes, such as *Micropterus*, *Lepomis*, *Ictiobus*, *Pimephales*, *Notemigonus*, and the like. In some places species of these fresh-water genera were found mixed with soles, *Gambusia*, and other Cyprinodonts.

This stream was examined at Nicholstone and for several miles both above and below that place.

Clear Creek is a stream very much like Dickinson Bayou. It rises in Harris County, south of Houston, and flows east to Galveston Bay about 7 miles above the mouth of Dickinson Bayou. Near its mouth it flows through Clear Lake, a small sheet of somewhat brackish water. Its banks are lined with a heavy growth of moss-covered oaks and other trees. Its fish life is essentially of the same character as that of Dickinson Bayou.

In Clear Lake, which is near the mouth of the creek, are found the various species of brackish-water fishes common to the region, and oysters are found in some parts of the lake.

Houston.—Considerable time was given to an examination of the waters about this city. It became readily apparent that the streams in the vicinity of Houston could not be depended upon for fresh water, as they are all more or less subject to sudden rises, when their waters become more or less muddy. The only stream we saw that is probably an exception to this is Hunter Creek west of Houston several miles. Excellent water, however, could be gotten by means of artesian wells, of which there is quite a number in and about Houston. One at the creosoting works is 670 feet deep. With a 6-inch pipe it flows about 100 gallons per minute. The temperature of the water at this well is 73°, and it is apparently fresh and suitable for fish. Another well, belonging to Mr. Jacob Kilper, in the western part of the city, was examined. Mr. Kilper has constructed a number of ponds here which are supplied chiefly from the artesian well. Carp that were placed in these ponds some years ago have done well. Eight or ten other species of fish have found their way into these ponds and seem to find the water satisfactory. Among these species are *Dorosoma cepedianum*, *Notemigonus chrysoleucus*, *Chænobryttus gulosus*, *Lepomis pallidus*, and *Gambusia patruelis*.

About 3 miles southeast from Houston is a tract of land known as the Kownslar Place, lying on Buffalo Bayou, which would prove a very suitable site for the station should artesian water be considered satisfactory. This land lies about 25 feet above Buffalo Bayou and slopes very suitably for the purposes for which it would be used. The Texas Transportation Railroad runs within an eighth of a mile of this place, and an electric line will be built to it very soon. Should this land be deemed suited to our purposes I am assured by prominent citizens of Houston that it could be obtained on terms satisfactory to the Commission.

Buffalo Bayou.—This bayou heads in the western part of Harris County, flows eastward past the city of Houston, and empties into the northern part of Galveston Bay. In general, it may be said to be a rather narrow, sluggish stream, usually pretty deep, and navigable as far as Houston, to which place the effect of the tide extends. There is very little current, and the bottom is of mud full of snags. Throughout its entire course it flows through sand or clayey country, there being little or no hard rock anywhere. Indeed, wells sunk to a depth of 700 feet in this country do not strike any solid rock. The water is moderately clear and cool. The banks are well wooded, the principal kinds of trees being pine, cedar, oak, magnolia, elm, sycamore, etc. *Tillandsia usneoides* is not common here.

We fished Buffalo Bayou at Shepherd's dam, about 2½ miles west of Houston or about 60 miles above its mouth. The stream at this place is about 20 feet wide and 3 feet deep. There are holes which are much deeper. The water was very low, as there had been no rains for some time. At times this stream is said to rise as much as 26 feet above low-water stage. We also fished at a point about 6 miles above Houston. Fish were quite abundant in this stream, both as to species and individuals. Such brackish-water genera as *Gambusia* and *Gerres* were found with such fresh-water forms as *Lepomis*, *Etheostoma*, *Aphredoderus*, and *Notropis*.

The temperature of the water at 11 a. m., November 17, was 61°; air, 49°; air at 8:30 a. m. was 45°.

Sims Bayou.—This is a small stream rising on the prairie southwest of Houston about 10 or 12 miles and flowing northeast to Buffalo Bayou, a few miles below Houston. The lower portion of the stream is lined on each side by a strip of timber, chiefly pine, while the upper part is through prairie land. This stream in dry weather becomes reduced to long, muddy pools. One of these which we examined was about 400 yards long, 10 to 40 feet wide, and 1 to 2½ feet deep. During times of drought these pools supply drinking water to great numbers of cattle on the surrounding grazing lands, and as a result the banks and bottom are tramped and cut up and rendered very miry. The water is, of course, more or less foul. Its temperature at noon, November 18, was 58°, that of the air being 47°. At 6 o'clock in the morning the temperature of the air was 45°.

Fish were found to be quite abundant here, the most common species being the pirate perch, sunfish, war-mouth, and *Gambusia*. A few crawfish, turtles, frogs, and a small bivalve (*Sphærium transversum* Say) were taken.

Big White Oak Bayou rises a few miles northwest of Houston and joins Buffalo Bayou at the town. It is a small creek which, at the time we saw it, was dried up into pools less than 10 feet wide and but a few inches deep. Oaks and other trees cover its banks. The bottom is muddy and full of snags. Not many species of fish were found here—minnows, suckers, and a few darters being the principal forms.

Hunter Creek is another small stream, a few miles in length, flowing into Buffalo Bayou from the north, about 8 or 9 miles west of Houston. This creek is very different from the other streams of this part of Texas, in that its water is exceedingly clear and rather cold. The temperature at 4 p. m., November 20, was 55°, the air being 70°. There is a good deal of limestone in the region through which it flows, and in this are numerous small springs whose uniting waters form the creek. The banks are usually rather high and steep, and are well wooded. The bed of the stream is 10 to 20 feet wide, but the water is usually in pools 2 to 4 feet deep, connected by shallow reaches but a few inches in depth. Over these shallow reaches there is considerable current.

A good deal of *Chara* was seen in one large pool, and a few bunches of *Nuphar* were noticed. Logs and snags filled the stream. But few species of fish were found, the most abundant being *Notropis venustus* and *Micropterus salmoides*.

San Jacinto River.—This is a small river rising north of Houston and joining Buffalo Bayou at its mouth. In the mouths of these two streams and in San Jacinto Bay—the small arm of Galveston Bay into which they empty—are the chief fishing-grounds for the Houston market. Among the species from that locality seen in the market were buffalo, channel cat, fork-tailed cat, yellow cat, war-mouth, fresh-water drum, calico bass, big-mouthed black bass, yellow bass, and several species of sunfish. The amount of valuable food brought daily to Houston from this place is enormous. The number of pounds of the two species of *Ictalurus* greatly exceeds that of any other species.

Trinity River.—The Trinity is one of the most important rivers in Texas. It rises near the northern line of the State and flows in a very tortuous course for about 1,000 miles southeast to Galveston Bay, into the northern part of which it empties. The Indian name of this stream was Arkokisa, thought by some to be a corruption of Orquisaco. La Salle called it the River of Canoes. We examined the Trinity River at Fort Worth, Dallas, Palestine, and Riverside. It is, through the greater part of its course, a rather sluggish stream, whose banks are moderately high and well wooded. We examined it most carefully in the vicinity of Magnolia Point, about 10 miles southwest of Palestine, November 23. At this place the stream was about 60 feet wide, 2 feet in average depth, and flowed with a 2-foot current. This indicates a discharge of about 14,400 cubic feet per minute. Both above and below Magnolia Point the current is less swift and the stream is deeper and wider. This is a very low stage of water, but during the spring rains, from March to May, the river rises very greatly, sometimes as much as 30 or 40 feet, thus rising above its rather high banks and flooding much of the adjacent land.

The shores are composed of sand and clay, with some ledges of sandstone and clay ironstone. This is especially the case on the left bank just below the ferry. In many places the shores are greatly eroded, forming numerous gullies or ravines coming down to the river. Generally the shores are covered with a pretty heavy growth of timber, willows of large size being most abundant. Besides these there are oaks, hickories, gums, and a few others. The bottom of the stream is muddy in some places, in others sandy or pebbly, and generally full of snags. The water is probably never very clear; its temperature at noon, when the air was 51°, was 53°.

The Trinity River is perhaps as good a fish stream as any of those of Texas flowing into the Gulf. We obtained no less than 30 species from it, the principal genera represented being *Leptops*, *Ameiurus*, *Noturus*, *Ictalurus*, *Ictiobus*, *Minytrema*, *Moxostoma*, *Notemigonus*, *Hybognathus*, *Hybopsis*, *Notropis*, *Phenacobius*, *Cliola*, *Dorosoma*, *Zygonectes*, *Micropterus*, *Chænobryttus*, *Pomoxis*, *Lepomis*, and *Etheostoma*.

Long Lake.—A few miles below Magnolia Point is Long Lake. This is evidently a portion of a former bed of the Trinity River. It lies near the river and is a little over a mile in length and 100 yards in average width. During the dry season it is 12 to 15 feet deep in the deepest places. Its shores are 6 to 10 feet above the surface of the water and are well covered with a good growth of small timber, chiefly post oak, with some hickory, gum, and mulberry. The bottom is of sand in most places, the north shore being a sandy beach sloping gradually to deep water. This small lake is well supplied with valuable food-fishes, and is a favorite fishing-place for the people of Palestine. Large-mouthed black bass, crappie, gaspergou, war-mouth, sunfish, channel cat, and buffalo are all abundant here. Crawfish, shrimps, and a large mussel (*Anodonta corpulenta*) were quite common.

NECHES RIVER.

This stream rises in the northern part of the State, near Canton, and flows southeast to Sabine Bay, into which it empties. It is much the same kind of a river as the Trinity, except that it is smaller. We examined the Neches River in the vicinity of the Palestine and Rusk Railroad Bridge, about 14 miles east of Palestine. Recent rains had put the river up out of its banks and made it about 300 feet wide and perhaps 8 feet deep. At low water it is here probably less than 30 feet wide. There was not much current and the water was muddy. The temperature of the water was 49.5° when that of the air was 63°. The banks are not high, and are of red clay and sand, there being some sandstone and clay ironstone in places. The banks are well timbered, oaks, pines, gum, and button willows being the most abundant. Collections were made in the river and in small ponds and a small branch near by. The fish found are essentially the same species as found in the Trinity River. A good many fresh-water shrimps and several crawfish were taken.

CORPUS CHRISTI.

Four days were spent at this place, but, as there seems to be no possibility of obtaining fresh water here, we did not examine the bay thoroughly. Corpus Christi Bay, however, and Matagorda Bay above it, are among the best oyster grounds on the Texas coast. Near the town is an oyster reef 3 miles long, which is used as a wagon road across an arm of the bay. The oysters on this reef are very abundant and of good quality. The Givens Oyster Company, organized at Corpus Christi about two years ago, is building up a large business. They obtain most of their oysters from Matagorda Bay.

SAN ANTONIO RIVER.

This river has its origin in a number of very large springs about 3 miles north of the city of San Antonio, upon the beautiful grounds of Col. Brackenridge. These springs come out in several places, close together, from a ledge of Cretaceous limestone. The minimum flow from the entire group of springs has been estimated at 22,500 gallons per minute, and the maximum at as great as 180,000 gallons. The average flow for the year is probably not less than 90,000 gallons per minute. The flow varies a great deal, and is said to be greatest following heavy rains in the Devil River region, 200 miles or more in the interior. The temperature of the water in all the springs of the group is about the same, being about 75° at noon, December 2. The water is very clear and, like all limestone water, appears blue in the deep places. The water from all these springs soon unites to form San Antonio River, a swiftly flowing stream, 20 to 40 feet wide and 2 to 8 feet deep.

Many species of water plants were found in the stream, certain kinds being very abundant in places. Suitable fish food, such as insect larvæ and small mollusks and crustaceans, appeared to be abundant. Among the mollusks noticed are *Physa halei*, *Limnæa desidiosa*, *Planorbis lentus*, and *Planorbis liedmanni*. One dead shell of a species of *Unio*, probably *Unio undulatus*, was found.

These waters seem well adapted to the usual species of fish of southern Texas, no less than a dozen species being found, among them black bass, sunfish, suckers, catfish, and eels. Crawfish were abundant.

About the springs and along the stream flowing from them is a heavy growth of trees, including oaks, elm, and pecan, the oaks being densely covered with *Tillandsia usneoides* and another beautiful epiphyte, *Tillandsia recurvata* Pursh.

There is another group of springs just in the north part of the city; these are called San Pedro Springs, and they flow perhaps half as much water as the San Antonio group. The ground about these springs belongs to the city and constitutes San Pedro Park, one of the most attractive of the numerous parks of San Antonio. The stream from San Pedro Springs, like that from San Antonio Springs, flows through the city, and the two come together south of the city.

The city gets its water supply from San Antonio Springs. Just below the springs are two pump-houses, where the water is pumped by water power to a reservoir a short distance east. This reservoir is said to be 150 feet above the city. To the north and west of the reservoir the land has a gradual slope down to the level of the river and lies in such a way as to make it a very suitable place for ponds. The water can be supplied from the reservoir and the ponds could be easily drained.

Just above the main group of San Antonio Springs is a small stream known as Olmos Creek, which is formed by numerous springs coming out along its banks. I did not learn of this creek until after leaving San Antonio, and was therefore not able to give it an examination, but I am informed by Mr. R. H. Russell, who is interested in the land, that, in his judgment, the conditions on Olmos Creek are very favorable. The land and water rights could probably be had here upon satisfactory terms.

GUADALUPE RIVER.

This stream is of moderate size, rising in southern central Texas and flowing southeast, by New Braunfels, to San Antonio Bay. We examined the Guadalupe in the vicinity of the wagon and railroad bridges near New Braunfels. The stream here is, at low water, from 75 to 150 feet wide and from 1 to 3 feet deep. The current is very swift in most places. The bed is in many places the Cretaceous limestone of the region; other reaches have the bottom covered with gravel; in a few places, where the current is less swift, there is some mud, and various pieces of *Algæ* and other water vegetation occur here.

Like most all the streams of this part of Texas the Guadalupe is fed chiefly by numerous springs issuing from the Cretaceous limestone along its course. As a consequence the water is usually exceedingly clear. During heavy rains, when there is considerable direct surface drainage, these streams, of course, become muddy for a short time. The temperature of the water at 4 p. m., December 3, was 68°, the air being 58°. Such fishes as minnows, darters, sunfish, and catfish were fairly abundant. Crawfish were also found in considerable numbers.

The Comal Springs.—There are a great many springs in the vicinity of New Braunfels, the principal group being known as the Comal Springs. There are several springs in this group situated upon the land of Mr. Joseph Landa, a little over a mile northwest of New Braunfels. The largest of these flows, perhaps, as much as 50,000 gallons per minute, and is certainly a magnificent spring. The other springs of the same group flow at least as much more.

The main spring comes out near the foot of a limestone hill, and after running rapidly for a short distance over a pebbly bottom and in a narrow channel it widens out into quite a pond with mud bottom and filled with vegetation. This pond also receives the water from numerous other springs, and has its outlet in Comal Creek (or the Rio Comal), which, after a course of 2 or 3 miles, joins the Guadalupe River. The water of these springs is, of course, very clear. The temperature is 75°.

About 2 miles north of the town is another group of springs, smaller than that just described. The amount of water is abundant, however, and very suitable for fish-cultural purposes. Suitable land could be had in the vicinity of either of these clusters of springs, so situated as to enable the water to be gotten readily under control.

Fishes are very abundant in the Rio Comal and the small streams flowing from the various springs to form that stream. The species represented are the same as those found in the Guadalupe, already mentioned. Among the small mollusks found in and about these streams we noted ***Planorbis bicarinatus*** Say and ***Goniobasis alexandrensis*** Lea. Each of these was quite abundant.

San Marcos River.—This river and the springs in the vicinity of San Marcos were examined December 4. The river has its rise in a number of springs at the foot of a limestone ledge or hill just above the town. All these springs together form a large deep stream, from the bottom of which, near the upper end, wells up the principal spring. The water here is not less than 12 or 15 feet deep, and the water boils up with such force and in such enormous quantity as to keep the surface of the river visibly convex immediately over the spring. Some distance below a dam has been built, which furnishes power for running a large mill and for the electric-light plant of the town.

The temperature of the water here, like that in all the springs of this part of Texas, is about 75°. Many water plants are found in the stream, particularly above the dam, and such species of fish as the large-mouthed black bass, sunfish, and various species of Cyprinoids are abundant.

The water of these springs is no doubt well fitted in every way for the culture of the various species of fish that are suited to the streams of Texas.

Just below the dam on the right bank of the stream, and right at the edge of the town, is a tract of land of some 25 acres, which lies exceedingly well for the purposes contemplated. Water can be carried in pipes from the dam to any part of the tract. The slope is sufficient for the easy construction of the ponds.

San Marcos is centrally located and has satisfactory railroad facilities.

Not far below the town the San Marcos River receives the Rio Blanco from the east. This stream is quite deep in places, and much like the San Marcos in general features.

Colorado River.—This is a large stream rising in the north central part of the State and flowing southeast to Matagorda Bay. We made investigations along this river in the vicinity of Austin. Just above the city and on the right side of the river is a large spring, known as Barton Spring. Barton Creek, which is formed by this and a number of smaller springs, is quite a good-sized stream. It has been dammed and furnishes an abundance of power for a flouring mill.

When the Texas State Fish Commission was in existence the station and ponds were located on the bank of this creek. The water was gotten upon the grounds by means of a small turbine wheel at the dam. This land could no doubt be had now for hatchery purposes and would seem to be very suitable ground, unless, indeed, the acreage be insufficient.

In a report by Jos. P. Frizell, on the proposed dam and waterworks for the city of Austin, it is stated:

> The Colorado, above Austin, flows in a deep cut or cañon worn in the limestone rock. It is skirted by limestone bluffs rising often to the height of 150 feet above the bed of the river, broken by the erosion of tributary streams. No extensive meadows or bottom lands exist. The river, in its normal condition, occupies but a small part of the channel in the rock, the remainder being occupied by alluvial deposits to the depth of average high water. In great floods the river spreads from bluff to bluff.

At this point, about 2 miles above Austin, the city has begun the construction of an immense dam for the purpose of furnishing water to the city and power to many manufactories and other industries requiring it.

Mr. Frizell further says:

> The channel in the rock is at this point about 1,150 feet wide at a height of 60 feet above the summer level of the river. The cross section of the channel is not far from level on the bottom, and is bounded by nearly perpendicular walls of rock rising to the height of a little over 60 feet on the city side of the river, and 125 or more on the other side. The river bed proper occupies not more than one-half of this width, the remainder of this being alluvial deposit, rising to the height of 40 or 50 feet above the river bed. The situation here is admirably well suited to the development of water power by a dam about 60 feet in height, the perpendicular face of rock rising to about that height, and thence receding from the river in a gentle slope, forming a bench on which the canal or feeder could be constructed, the alluvial strip of ground between the canal and river furnishing sites for pumping and power stations, and any other establishments requiring power.
>
> The Colorado, at Austin, drains some 40,000 square miles, and, of course, carries, at times, an enormous flow of water. The highest flood, within the memory of the people now living, was some 45 feet above low water, and from the best data I can obtain the flow of the stream was some 250,000 cubic feet per second.

This dam is now well under way, and will be completed within a year or two.

About 2,000 feet below the dam, on the left bank of the river, is a tract of land very suitable for a station. Still farther down, less than three-eighths of a mile, is another equally good tract. The top of the dam will be at least 10 feet above the highest part of either of these tracts. All this land slopes gently toward the river and lies beautifully for the laying out of ponds. Ordinarily water taken from the dam would prove suitable, but at times when the river is roily, water could be gotten from the large reservoir to be constructed on the high hills above the dam. The city would doubtless make satisfactory arrangements and guarantees as to water rights.

If land can be had on reasonable terms, the location would prove very desirable.

NOTES ON TEXAN FISHES, WITH DESCRIPTIONS OF NEW SPECIES.

The brief time allowed for the preparation of the first part of this report was not sufficient for a critical study of all the material collected. Only the species of Cyprinoids and Cyprinodonts have been thus far carefully studied, and it has seemed best to publish in this connection the results of the study of only those two families, reserving for another paper the report upon the other fishes collected. In that paper will also be given illustrations of the other new species here described.

1. **Campostoma anomalum** (Raf.).

One specimen, 4 inches long, from the San Marcos River near San Marcos. Head, 4¾; depth, 5⅛; eye, 4; D. 9; A. 7; scales, 8–54–7. Compared with specimens from the Yellow River, at Plymouth, Indiana, the Texas specimen has the scales smaller (7–46–5 in the Yellow River specimens), the lateral line less decurved, interrupted on about 10 scales of the caudal peduncle, reappearing upon the last 4 or 5 scales.

The types of *C. formosulum* Girard came from San Antonio, and have the scales about the same as the Indiana specimens.

2. **Dionda episcopa** Girard.

One specimen 2¾ inches, and one 1½ inches long, from the Comal Spring, New Braunfels. Head, 4½; depth, 4⅓; eye, 3; D. I, 8; A. I, 8; scales, 7–40–4; teeth, 4–4; grinding surface well developed; intestine long; peritoneum black.

Body rather slender, head moderate; origin of dorsal over ventrals, a little nearer tip of snout than base of caudal, its base two-thirds its height or one-half length of head.

Color in alcohol, dark olive above, covered with numerous fine, dark specks; side, with a broad plumbeous band, running from tip of snout through middle of eye to base of caudal, where it ends in a black blotch, this band for the most part lying just above the lateral line; lower jaw, suborbital, lower opercular region, and body below lateral line, pale but with a few scattered dark punctulations.

In his "Researches upon the Cyprinoid Fishes Inhabiting the Fresh Waters of the United States West of the Mississippi Valley,"[*] Girard establishes the genus *Dionda* and described as new ten species belonging in it (*Dionda episcopa*, *serena*, *texensis*, *papalis*, *argentosa*, *chrysitis*, *plumbea*, *melanops*, *couchi*, and *spadicea*). The first seven of these species were described from Texas waters, the next two from Mexico, while the last one named was from Fort Smith, Arkansas. In 1885 all the types of these species that could be found either in the U. S. National Museum or in the Philadelphia Academy were studied by Dr. Jordan, who gave[†] the following identifications:

Girard's species.	Jordan's identifications.
Dionda episcopa	Dionda episcopa Grd.
Dionda texensis	Do.
Dionda argentosa	Do.
Dionda serena	Dionda serena Grd.
Dionda papalis ‡	? Dionda serena Grd.
Dionda chrysitis	Dionda serena Grd.
Dionda melanops	Dionda melanops Grd.
Dionda couchi	? Dionda melanops Grd.
Dionda plumbea ‡	? Zophendum ? plumbeum Grd.
Dionda spadicea ‡	? Zophendum ? plumbeum Grd.

‡ The types of those indicated by a (‡) can not be found and are probably lost.

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[*] Proc. Acad. Nat. Sci. Phila. 1856.

[†] Proc. U. S. Nat. Mus. 1885, 121.

Girard's types of *Dionda episcopa* consist of two specimens, each about 3¼ inches long, collected in the Pecos River by Capt. J. Pope, and bear the U. S. N. M. No. 45. They are still in fair condition and resemble very closely my specimens from the Comal Spring; in the types, however, the head is a trifle longer, the depth some greater, the dorsal appears to be a little farther forward, and the eye is not quite so large.

The types of *D. texensis* bear the U. S. N. M. No. 44, and consist of two specimens, 2 and 2¾ inches long, respectively, from the Nueces River; they can not be distinguished from *D. episcopa*.

The type of *D. argentosa* is a single specimen, 2¾ inches long, No. 32 U. S. N. M., from San Felipe Creek. This specimen is in poor condition; it does not seem to be identical with *D. episcopa*, but is a heavier, stouter species; head, 3⅛; depth, 3¾; eye, 3⅔; dorsal less anterior.

3. Hybognathus nuchalis Ag.

This species was found to be very abundant in certain places. The collection contains 143 specimens from the Neches River, east of Palestine; 43 from the Trinity, at Magnolia Point; and 10 from Big White Oak Bayou, at Houston.

Many of the Neches River specimens have the lower jaw covered with small cystic tumors, caused by the presence of psorosperms of some species of *Myxosporidia*, appearing as small whitish elevations. Some of these specimens were found to be infested about the intestines with a trematode of some species. These parasites are now being studied by Dr. R. R. Gurley, of the U. S. Fish Commission, who expects to be able to report upon them at no distant date.

4. Cliola vigilax (B. and G.).

This is one of the most widely distributed species of the family of minnows; we found it in abundance at each of the following places: Neches River, 14 miles east of Palestine; Trinity River, at Magnolia Point; Long Lake near Magnolia Point, Hunter Creek, Big White Oak Bayou, and Buffalo Bayou near Houston; San Marcos River, San Marcos; and Guadalupe River, near New Braunfels.

These specimens do not differ apparently from more northern specimens. The individuals from the vicinity of Houston are unusually large.

5. Notropis cayuga atrocaudalis, var. nov.

Head, 4⅖; depth, 4⅖; eye, 3⅕, a little greater than snout; D. I, 8; A. I, 7; scales, 7–36–4, about 13 before dorsal; teeth, 4–4, strongly hooked, grinding surface developed.

Body moderately elongate, not much compressed, back little elevated; head short and bluntly conic, snout shorter than eye; caudal peduncle short and deep; origin of dorsal slightly behind ventrals, nearer caudal peduncle than snout; anal small, its longest rays shorter than head; lateral line complete.

Color in alcohol: Above olivaceous, profusely covered with fine brownish punctulations, thickest around border of scales, not crosshatched; side with a black band half width of eye, following direction of lateral line and ending in a black spot at base of caudal; this band also extends across cheek through eye and around snout; top of head dark, snout above the black band pale; lower half of head pale, opercles silvery.

The 17 specimens upon which this description is based were obtained in the Neches River, east of Palestine, Texas, November 24, 1891. They very closely resemble *N. cayuga* Meek, but I hesitate to identify them with that species on account of the somewhat longer snout and the complete lateral line.

6. Notropis deliciosus (Girard).

Moniana deliciosa Girard, Proc. Acad. Nat. Sci. Phila. 1856.

This appears to be an abundant species in southern Texas, as indicated by the specimens in the collection, viz:

Kilper's Pond, Houston	1
Big White Oak Bayou, Houston	2
Buffalo Bayou, Houston	9
Hunter Creek, Houston	31
Rio San Marcos, San Marcos	26
Guadalupe River, New Braunfels	82
San Antonio River, San Antonio	76

Numerous specimens examined give the following measurements: Head, $4\frac{1}{5}$ to $4\frac{3}{5}$; depth, $4\frac{1}{3}$ to $4\frac{3}{4}$; eye, 3; D. I, 8 or 9; A. I, 8; scales, 6–36 or 37–3, 13 or 14 before the dorsal.

Body slender, head moderate; snout rather blunt, less than eye or interorbital width; the mouth not large, subinferior, oblique, lower jaw included; origin of dorsal slightly behind base of ventrals, midway between tip of snout and base of caudal fin, high, the longest rays, which are the anterior ones, nearly as long as head; anal base short, its longest rays $1\frac{2}{5}$ in head.

Color in alcohol: Scales above lateral line with numerous fine black specks, thickest along border of each scale, forming cross-hatching, darkest along middle line of back, a black blotch on back in front of dorsal and another on caudal peduncle at beginning of caudal fin; base of dorsal fin dusky; top of head and upper jaw dark; a few dark specks on upper part of opercle, the lower portion and the lower jaw pale; side with a broad plumbeous band, about one scale wide, lying along lateral line, this dusted over with fine, darker punctulations. This color description applies more especially to the San Antonio specimens. Those from the other places, especially those from about Houston, are much paler, but the general pattern of coloration is the same. Many of the females of the San Antonio lot contained well-developed eggs.

7. Notropis nux, sp. nov.

This species is based upon specimens from the following places:

Neches River, Palestine	10
Trinity River, Palestine	1
Long Lake, Palestine	1

Head, 4 to $4\frac{1}{5}$; depth, $4\frac{1}{2}$; eye, 3 to $3\frac{1}{3}$; D. I, 8; A. I, 7 or 8; scales, 6–37 or 38–3 or 4, 13 or 14 before the dorsal; teeth, 1, 4–4, 2 in the Long Lake specimen, apparently only 1, 4–4, 0 or 1 in the others; grinding surface developed and somewhat crenate, especially in the Neches River specimens.

Body rather slender, somewhat elevated, head subconic, snout rather blunt, a little decurved; mouth moderate, oblique, maxillary not reaching orbit, lower jaw slightly included; eye rather large, about 3 in head, equal to snout, also to interorbital width; caudal peduncle long and slender, its least depth $2\frac{1}{2}$ in head. Origin of dorsal fin over insertion of ventrals, nearer snout than base of caudal, height of fin equals length of head, base short; anal smaller; pectorals short, not reaching ventrals, which, in turn, do not reach the anal; caudal long and widely forked; lateral line complete, nearly straight; peritoneum pale, with a few brown spots.

Color in spirits: Greenish above, covered with numerous fine, brownish punctulations, thickest along edges of scales, forming cross-hatching extending about one-fifth way down the side; trace of a dark vertebral line; side with a somewhat distinct plumbeous band, heaviest on caudal peduncle and ending in most specimens in a small but distinct caudal blotch; this band also extends across opercles, through the eye and upon the snout; between this band and the cross-hatching of the back is a pale yellowish area, about one scale wide with a few scattered specks showing under the lens; body below lateral line pale, with few specks except about base of anal fin and along under side of caudal peduncle where they are numerous; fins with few very fine dark points.

Etymology: Latin, *nux*, nut; in allusion to the Neches River, as Neches is said to mean *nut*.

8. Notropis nocomis, sp. nov.

Head, 4¼ to 4½; depth, 4¾ to 5; eye, 3 to 3¼; D. I, 8 or 9; A. I, 8; scales, 6–36–3; teeth, 1, 4–4, 1, small, hooked, the grinding surface narrow, apparently a little crenate; peritoneum silvery, with a few small dark specks.

Body rather slender, but little elevated; head heavy, resembling that of *Cliola vigilax;* snout blunt and rounded, about equal to eye; mouth small, inferior, horizontal, lower jaw included and overhung by the rounded snout; maxillary short, not nearly reaching orbit; eye large, equal to interorbital width; preorbital broad; caudal peduncle long and slender, its least depth less than half length of head. Dorsal inserted directly over the ventrals, high, the longest rays 4 times in length of body, one-fifth longer than head, or twice length of fin, reaching middle of anal when depressed, the free margin nearly straight; anal resembling dorsal in shape, but smaller, its longest rays as long as head; pectorals short, not reaching ventrals; ventrals scarcely reaching anal fin; lateral line complete, nearly straight.

Color in alcohol: Yellowish, upper parts of body with numerous fine brown punctulations, chiefly margining the scales so as to form cross-hatching; lower parts plain yellowish; a dark lateral band, faint on the anterior half of side, plainest on caudal peduncle; no caudal spot; fins, under the lens, show a few fine specks; top of head dark, snout pale.

This species is described from about 130 specimens, each about 2½ inches in total length, taken in the Trinity River at Magnolia Point, near Palestine, Texas, and five examples from the San Marcos River at San Marcos, Texas. These specimens are indistinguishable by me from specimens collected at New Braunfels, Texas, in 1884, by Drs. Jordan and Gilbert, and referred to in Jordan's Catalogue of 1885 under the manuscript name *Notropis nocomis*. In the paper on their Texas collection, these authors concluded that their specimens were identifiable with Girard's *Moniana deliciosa*, and consequently gave no description. I obtained numerous specimens at San Marcos, New Braunfels, and elsewhere, of what agrees well with the types of *Moniana deliciosa* Grd., with which I have compared them, but they are quite a different fish from that for which I adopt the name *nocomis*. In *Notropis nocomis* the head is heavier and broader, the snout is much more blunt, the mouth smaller and more nearly horizontal, and the lower jaw is shorter and included. I have, therefore, thought best to describe this form as a new species, adopting for it the manuscript name of Jordan and Gilbert.

In the Trinity River, at Magnolia Point, this species was found in great numbers on a ripple when the current was pretty strong.

One specimen, 2½ inches long, from Buffalo Bayou, I refer to this species for the present, though it presents some differences. The body is a little more slender, the mouth some larger and less inferior, and the color is darker; the dark lateral band is well developed and extends across the opercles and around the snout. These color differences, however, might well be due to the quite different characters of the streams from which the specimens came.

The specimen from Buffalo Bayou measures as follows: Head, 4¼; depth, 5¼; eye, 3, greater than snout; D. I, 8; A. I, 8; scales, 6–38–3; teeth, 1, 4–4, 1. Height of dorsal fin greater than length of head.

9. Notropis lutrensis (B. and G.).

Neches River east of Palestine	1
Trinity River, Magnolia Point, near Palestine	180
San Marcos River, San Marcos	537
Guadalupe River, New Braunfels	40
San Antonio River, San Antonio	4

This species is, as shown above, exceedingly abundant in the Trinity and San Marcos rivers, and is quite common at each of the other localities where specimens were found by us. This is one of the most variable and most widely distributed of the Southwestern Cyprinoids.

10. Notropis venustus (Girard).

Cyprinella venusta Girard, Proc. Acad. Nat. Sci. Phila. 1856, 198, and Mex. Bd. Survey, 54, Pl. XXXI, Figs. 1–4, 1859 (Rio Sabinal, Texas, collected by Dr. C. B. Kennerly).

Notropis venustus Jordan and Gilbert, Proc. U. S. N. M. 1886, 14 (Red River, Fulton, Ark.); 19 (Lampasas River, Belton, Tex.); 20 (Colorado River, Austin, Tex.).

This, one of the most attractive of Cyprinoids, is an abundant species in many of the streams examined by us. The following specimens are in the collection:

Neches River, east of Palestine, Texas	3
Trinity River, Magnolia Point, Texas	2
Buffalo Bayou, Houston, Texas	12
Big White Bayou, Houston, Texas	19
Hunter Creek, Houston, Texas	73

The specimens from about Houston are very fine and large, some of them being as much as 4 inches long. The black caudal spot is larger and not so far back upon the caudal fin as shown in Girard's figure.

11. Notropis swaini Jordan and Gilbert.

Alburnus megalops Girard, Proc. Acad. Nat. Sci. Phila. 1856, 193 (San Felipe Creek, Texas).

Alburnellus megalops Girard, Mex. Bd. Survey, 52, Pl. XXIX, figs. 1–4, 1859 (San Felipe Creek, Texas). (Name preoccupied in this genus.)

This species is abundant in Texas, and specimens were obtained by us at the following places:

San Marcos River, San Marcos, Texas	21
Comal Creek, New Braunfels, Texas	36

Drs. Jordan and Gilbert obtained this species in Comal Creek, San Marcos River, and the Colorado River at Austin.

Head, 4 to 4¼; depth, 4 to 4⅔; eye, 2⅘ to 3, greater than snout; D. I, 8; A. I, 8 or 9; scales, 7–38–3, about 14 before the dorsal; teeth, 1, 4–4, 1 or 2, somewhat hooked and with evident grinding surface.

Body moderately elongate, compressed, back little elevated; head rather heavy, snout short and obtuse, mouth large, oblique, lower jaw slightly projecting, maxillary extending to below level of pupil; eye quite large, greater than width of interorbital space or length of snout; caudal peduncle moderate, its least depth equal to distance from tip of snout to middle of eye; fins not large, dorsal inserted behind the ventrals; origin of anal behind last rays of dorsal; lateral line continuous, slightly decurved.

Color: Upper third of body pale yellowish, with numerous small brown specks arranged chiefly parallel with the borders of the scales, not presenting a true cross-hatched appearance; top of head dark, snout, region about the nostrils, and supraocular region paler; a dark dorsal line from nuchal region to caudal fin; lower two-thirds of body silvery, the upper part being more or less plumbeous forming a broad band well defined above, but less so below; lower third of caudal and forward to tips of ventrals plain yellowish; opercles and cheeks very silvery; breast and lower jaw pale.

12. **Notropis dilectus** (Girard).

Alburnus dilectus Girard, Proc. Acad. Nat. Sci. Phila. 1856, 193 (Arkansas River, near Fort Smith).

Four specimens of what I for the present refer to this species were obtained from Long Lake, near Palestine; one from Neches River, east of Palestine; and several hundred specimens, the largest about 2¾ inches long, from the Trinity River at Magnolia Point. Drs. Jordan and Gilbert obtained specimens of what they referred to Girard's *dilectus* from the Sabine River, Long View, Texas; Saline River, Belton, Arkansas, and from the Arkansas River near Fort Smith.

Girard's original description of the species is as follows:

> 1. *Alburnus dilectus*, is about three inches and a half in total length; the head forming a little less than the sixth part of it. The greatest depth is nearly equal to the length of the head. The diameter of the circular eye is contained a little more than three times in the length of the side of the head, and less than once in advance of its anterior rim. There are ten longitudinal rows of scales between the insertion of the ventrals and the base of the dorsal. The lateral line is upon the fourth row from the ventrals upwards. The color is uniform yellowish red with a lateral silvery streak.

The types of this species consist of two specimens, 3 and 3⅖ inches long respectively, and are numbered 71, in the U. S. National Museum catalogue. They are in very good condition, and present the following measurements: Head, 4½ (5½) and 4¼ (5¼); depth nearly equal to length of head; eye, 3½ in head in each, longer than snout.

The specimens obtained by us may be described as follows: Head, 4 to 4⅓ (5 to 5⅓); depth, 4¾ to 5 (6 to 6¼); eye, 3 to 3⅕; scales, 7–38–3.

Body slender, compressed, scarcely elevated; head narrow; eye large, greater than snout, equal to width of interorbital space; mouth rather large, quite oblique, maxillary reaching orbit.

Dorsal much nearer base of caudal than snout, considerably behind ventrals, high, its anterior rays longest, free margin straight; anal larger than dorsal, free margin concave; caudal deeply forked; pectorals short, not reaching ventrals, which are also short, not reaching anal. Lateral line somewhat decurved. Peritoneum silvery, with numerous dark-brown specks. Color, very pale yellowish, side with plumbeous band very indistinct on anterior third of side, plainest on caudal peduncle; back and sides down to lateral line covered sparsely with small dark specks arranged mostly along border of scales, largest just above lateral line; top of head dark, snout pale, lips dark-edged; a row of somewhat larger specks along median line of back from occiput to caudal fin; body below lateral line plain yellowish without any specks except a single row at base of anal fin on each side, usually quite distinct in most specimens; entire side of head silvery; fins, especially dorsal and anal, with a few small dark points. The specimens from Long Lake are a little more heavily spotted than those from the river.

13. Notropis fumeus, sp. nov.

Allied to *Notropis dilectus* (Grd.). Head, 4½ to 4⅘; depth, 4⅘ to 5; eye, 3 to 3⅓; D. I, 8; A. I, 11; scales, 7–40–3; teeth, 2, 4–3 (?) 2, hooked.

Body slender, greatly compressed, dorsal and ventral outline gently arched; head moderate, conic; snout pointed, shorter than eye; eye large, equal to interorbital width; mouth rather large, oblique, lower jaw projecting, scarcely included, maxillary scarcely reaching orbit; caudal peduncle long, compressed, its least depth equal to distance from tip of snout to middle of pupil; lateral line complete, considerably decurved. Origin of dorsal behind ventrals, nearer base of caudal than tip of snout, its height less than length of head; anal larger, its base 1⅓ in head; pectorals short, not reaching ventrals; ventrals short, just reaching vent. Peritoneum pale silvery, with some small dark specks.

Color: Dark yellowish above, thickly covered with small dark-brown specks; the majority of these are very small, but interspersed among them are a good many of larger size, spots most numerous in certain lines forming distinct cross-hatching; a dark line along middle of back; side with a broad, dark plumbeous band, overlaid with numerous rather large brown spots, thickest and darkest toward caudal peduncle; this band also extends across opercle and around the snout; lower jaw with anterior half darkened by numerous specks; lower parts, pale silvery, with few or no specks except at base of anal fin, which has a rather heavy row on each side, in some specimens continuing along under side of caudal peduncle to caudal fin; dorsal, anal, and caudal with some black on membranes, pectorals edged with black.

This species is based upon 4 specimens, each a trifle over 2 inches in length, taken in Hunter Creek, about 9 miles from Houston, Texas, November 20, 1891. It very closely resembles *N. dilectus* (Grd.), and may prove to be not specifically distinct from that species; the lateral line is, however, more decurved, the scales seem to be some smaller and the color is markedly different in the distinctness of the broad plumbeous lateral band.

14. Notropis notemigonoides, sp. nov.

Head, 4 to 4¼; depth, 4¼ to 4½; eye, 3¼ to 3½; D. I, 8; A. I, 10 or 11; scales, 10–41–3, about 29 before the dorsal; teeth, 2, 4–4, 2, hooked, grinding surface moderately broad, plainly crenate.

Body slender, greatly compressed, somewhat elevated; head conic, snout pointed, about equal to eye; mouth large, oblique, lower jaw slightly projecting, maxillary reaching orbit; eye rather large, equal to snout, but a little less than interorbital width; caudal peduncle long and compressed, its least width only half diameter of orbit. Fins moderate, dorsal inserted behind ventrals a distance equal to diameter of eye, much nearer base of caudal fin than snout, its rays about as long as head, free margin straight; anal with longer base but shorter rays; pectorals falcate, not reaching ventrals; ventrals short, scarcely reaching anal; caudal long and deeply forked. Scales rather small and closely imbricated, very small and crowded before the dorsal; lateral line complete, greatly decurved, as in *Notemigonus.*

Color in spirits: Pale yellowish above, silvery below; upper half of body sprinkled over with numerous small, dark-colored spots, thick enough along median line of back to form a narrow dark vertebral band from occiput to base of caudal fin; the spots on anterior part of side so arranged as to form about sixteen obtuse angles fitting into each other, the angles opening forward, thus >>, these markings being upon alternate scales; a silvery band on caudal peduncle overlaid with fine dark specks; top of head dark, snout pale, but with many fine punctulations; tip of lower jaw with some small specks; sides of head silvery; all the fins except the pectorals with many fine dark points, most numerous on dorsal and caudal. This curious species of *Notropis* bears a very close superficial resemblance to *Notemigonus chrysoleucus*, but of course its generic relationship is with the *Notropes.*

This species is based upon the following specimens: Three specimens, 2 to 2½ inches long, from Neches River, 14 miles east of Palestine, Texas, November 24, 1891, and 3 specimens of about the same size, from Sims Bayou, near Houston, Texas, November 18, 1891. The specimens from Sims Bayou, like all other fishes from that place, are very much bleached, but show the same general pattern of coloration as those from the Neches River.

15. Phenacobius mirabilis (Girard).

Exoglossum mirabile Girard, Proc. Acad. Nat. Sci. Phila. 1856, 191 (Arkansas River, Fort Smith).

Two specimens from the Trinity River at Magnolia Point, near Palestine. Also taken by Drs. Jordan and Gilbert in the Sabine River at Longview, Texas, and the Arkansas River near Fort Smith.

16. Hybopsis æstivalis marconis J. and G. (Pl. XXXV.)

Hybopsis æstivalis marconis Jordan and Gilbert, Proc. U. S. N. M. 1886, 22 (San Marcos River).

Head, 4⅓; depth, 5½; eye, 3½, less than snout, but equal to interorbital width.

We found this fish very abundant in the San Marcos River below San Marcos, and in the Guadalupe River near New Braunfels. It seems to be like *Hybopsis hyostomus*, a fish of the rapid, open stream, as we found it only where the water was pure and clear and the current very swift. At a single haul with a 12-foot seine in the Guadalupe River, between the two bridges near New Braunfels, several hundred fine specimens were taken.

17. Opsopœodus osculus, sp. nov.

I refer to this species specimens from the following places:

Neches River east of Palestine, Texas, November 24, 1891	20
Long Lake, Palestine, Texas, November 25, 1891	2
Buffalo Bayou, Houston, Texas, November 16, 1891	4
Kilper's Ponds, Houston, Texas, November 21, 1891	4
Sims Bayou, Houston, Texas, November 18, 1891	48
Dickinson Bayou, Nicholstone, Texas, November 14, 1891	4

Head, 4⅓ to 4⅔; depth, 4⅓ to 5; eye, 3; D. I, 10; A. I, 8; scales, 6 or 7–38 to 41–3 or 4; teeth, 4–4 or 4–5, more or less serrate and hooked, the pharyngeals small and weak; peritoneum silvery, with small brown specks.

Body rather slender, little elevated, head subconic, its depth at eye but half its length, snout blunt, shorter than eye; mouth very small, almost vertical, scarcely any lateral cleft; scales moderate, rather deeper than long, those in front of dorsal small; breast naked; lateral line complete, somewhat decurved. Origin of dorsal slightly behind that of ventrals, nearer snout than base of caudal, its height equal to length of head, pointed, the free margin nearly straight, inclined to be concave; anal small, its base one-half length of head, about equal to the dorsal in height.

Color of Neches River specimens pale, the upper parts of the body with numerous fine brown specks arranged chiefly along edge of scales so as to give a regular cross-hatching, this covering the caudal peduncle; middle of side with a plumbeous band about one scale wide, extending also across cheek and upon snout; two rows of small spots above and parallel with the plumbeous band and one below it, not distinct in some specimens; top of head dark, an indistinct line from nape to origin of dorsal fin; lower parts of body plain except on posterior portion where the cross-hatching extends to under side of caudal peduncle; no spot at base of caudal; fins plain or with a few scattered punctulations on dorsal and anal, no evidence of the large black area found on dorsal fin of *O. emiliæ.*

The specimens from Long Lake, Dickinson Bayou, Buffalo Bayou, and Kilper's Ponds agree in color with those from the Neches River, while all the specimens from Sims Bayou are nearly uniform pale yellowish throughout, there being no markings anywhere except a very faint lateral band and a few scattered punctulations discernible only under a lens; dorsal and anal wholly plain. The pale, bleached appearance of the specimens from Sims Bayou is quite certainly due to the peculiar character of the place in which they were found, it being a shallow, isolated, and stagnant pool with mud bottom, containing scarcely any vegetation and lying exposed on the open prairie. Thousands of cattle from the surrounding prairie come to this pool for water during the dry season, and, in consequence, the banks are much cut up and the water is more or less foul. These conditions, of course, have their effect upon the fishes found there, and all the species obtained there by us present the same faded appearance.

This species is quite close to *O. emiliæ* Hay, but may be distinguished from it by the less depth of the head, the more pointed dorsal and anal fins, and by the very different coloration. A specimen of *O. emiliæ* from Mayfield Creek, Kentucky, collected by Mr. A. J. Woolman, has the depth at the eye half length of head, and the free margin of the dorsal, as well as that of the anal, is convex, while in the Texas specimens it is straight or even concave, due to the greater length of the first three rays. These small differences, together with the entire absence of the large black spot on the dorsal fin which constitutes such a noticeable feature in the coloration of *O. emiliæ*, and the presence (except in the bleached specimens) of a much more distinct plumbeous lateral band than is found in any of the specimens of *O. emiliæ* that I have examined, do not permit me to believe that the two are specifically identical. To regard the Texas specimens as being *O. emiliæ* would require, it seems to me, either that the lateral band should be obsolete or that there should be some evidence of the presence of the black area on the dorsal fin; for it would seem that conditions which would result in *intensifying* one of these color markings would not *obliterate* the other.

This species differs from the other of the two known species of this genus (*O. bollmani*, recently described by Dr. Charles H. Gilbert, from Buckhead Creek, Georgia), in having the lateral line complete and in not having the black caudal spot so conspicuous in that species.

18. Notemigonus chrysoleucus (*Mitch.*).

Numerous specimens of this widely distributed minnow were taken at each of the following places: Neches River, 14 miles east of Palestine: Long Lake and Trinity River, near Palestine; Sims Bayou, Kilper's Ponds, and Big White Oak Bayou, at Houston; and Dickinson Bayou, near Dickinson.

19. Cyprinodon variegatus (*Lacépède*).

Thirty specimens of this species were obtained at Galveston, 3 from Dickinson Bayou, and 10 from Corpus Christi. It is abundant both at Galveston and Corpus Christi. This is the form described by Baird and Girard as *C. gibbosus*, but our specimens do not seem to differ materially from northern ones.

In our study of this and related species we had occasion to compare specimens of *Cyprinodon carpio* Günther and *C. mydrus* Goode & Bean, and can not see any tangible differences.

20. Fundulus similis (*B. & G.*).

The collection contains 14 specimens from Galveston and 2 from Corpus Christi. It is an abundant species at each place.

21. Fundulus heteroclitus (*L.*).

A dozen specimens from Corpus Christi, 2 from Dickinson Bayou, and 14 from Galveston, at each of which places it is abundant.

22. Fundulus pallidus, *sp. nov.* (*Pl. XXXV.*)

One specimen, 1¾ inches in total length, taken in Galveston Bay, near Swan Lake, Texas, November 10, 1891. Head, 3½; depth, 4; eye, 3½; D. 12; A. 11; scales, 31–11, about 16 before the dorsal.

Body, stout; head, heavy; caudal peduncle long and much compressed; snout, short and blunt, shorter than eye, which is two-thirds the width of the interorbital space; humeral scale not enlarged, two rows of scales on the cheek; mouth rather small, little oblique, teeth pointed, in more than one series, the outer enlarged. Dorsal fin over the anal, its origin midway between base of caudal and posterior edge of opercle, or midway of total length, its ray short, about 1⅓ in head; anal rays about equal in length to those of dorsal.

Scales medium, not firmly attached, 31 in longitudinal series, 11 in transverse from dorsal to anal, about 10 before the dorsal.

Color, pale yellowish; sides with about 13 narrow, dark, vertical bars, much narrower than the pale interspaces, not extending on the back or belly; scales sparsely covered with fine dark punctulations, few on the vertical fins and head; a large oblong black spot on the back immediately in front of dorsal fin.

This species is allied to *Fundulus similis* Baird and Girard, but the head is less pointed, the snout very much shorter, it being shorter than the eye, while in *F. similis* it is 1½ times the eye, the dorsal has one more ray and the anal two or three more, the color is paler, the bars less distinct, there is no dark dorsal line as in the other, while the pronounced black spot in front of the dorsal is not found on *F. similis*.

23. **Fundulus xenicus** Jordan and Gilbert.

Fundulus xenicus Jordan and Gilbert, Proc. U. S. N. M. 1882, 255 (Pensacola); Synopsis, 1882. 892.
Adinia multifasciata Girard, Proc. Acad. Nat. Sci. Phila. 1859, 117.

Four specimens of this interesting little species were taken in Galveston Bay. Head, 3; depth, 2½; eye, 3; snout, 3; D. 12; A. 12.

Body greatly compressed, the back elevated, profile from snout to dorsal nearly straight, this forming an acute angle with the ventral line from snout to anal fin; caudal peduncle very deep, its greatest depth 1¼ in head; dorsal large, its origin in front of anal, the longest rays nearly as long as head. The dusky blotch said to be below and behind the eye is not evident.

24. **Zygonectes funduloides**, sp. nov. (Pl. XXXV.)

This species is described from two specimens, each 1½ inches long, from Dickinson Bayou, Dickinson, Texas, November 13, 1891. Head, 3⅓; depth, 4½; eye, 3¼; D. 9 or 10; A. 9; scales, 35–11, 24 before the dorsal.

Body moderately robust, width at pectorals a little greater than greatest depth of head; snout rather blunt, equal to eye; interorbital width 1⅔ times diameter of eye; caudal peduncle deep and compressed; mouth not large nor greatly oblique; teeth pointed, the outer series being somewhat enlarged; peritoneum pale. General color in spirits, dark olivaceous, sides with 10 to 14 dark vertical bars which are usually two to three times as wide as the intervening silvery ones; in one specimen the bars extending from the dorsal to the anal are about equal in width to the silvery interspaces; whole body, including all the fins, profusely dusted over with minute brownish spots which are very numerous on back and top of head; a narrow, dark line extending from nape to origin of dorsal.

Dorsal fin small, slightly in front of anal, its origin midway between posterior edge of opercle and base of caudal fin, the longest rays about equal to base of fin, or half length of head.

If the characters which are used to distinguish the genus *Fundulus* from *Zygonectes* are really of generic value, the small size of the dorsal fin would put this species in *Zygonectes*, though the position of the fin is rather that of *Fundulus*. I have compared these specimens with numerous young individuals of *F. heteroclitus* collected by Dr. H. M. Smith at St. George Island, Maryland, and find them very similar in general appearance; in *Z. funduloides*, however, the dorsal is placed further back, and has fewer rays (9 or 10 instead of 12), the anal is smaller (9 instead of 11); the pattern or coloration is the same, but the contrasts are more marked, and instead of the dark dorsal band found in this species the young of *F. heteroclitus* have a small dusky area at base of dorsal in front; the young have an ocellus upon last rays of dorsal, which is not found in the other species.

25. **Zygonectes pulvereus**, sp. nov. (Pl. XXXVI.)

This species is based upon the following specimens:

Nine specimens, 1⅗ to 2 inches long, from Dickinson Bayou, Dickinson, Texas, November 13 and 14, 1891.

One specimen, 1½ inches long, from Buffalo Bayou, Houston, Texas, November 16, 1891.

One specimen, 1½ inches long, from the mouth of Oso Creek, Corpus Christi, Texas, November 28, 1891.

Head, 3½; depth, 4½; eye, 3½; D. 10 (11 in one specimen); A. 10 (occasionally 9); scales, 35–11, about 22 before the dorsal.

Body stout, heavy forward; head broad and flat, the snout short and blunt; caudal peduncle long, deep, and greatly compressed; eye moderate, 1½ in interorbital width, greater than snout; humeral scale not enlarged, four rows of scales on cheek; mouth rather small, but little oblique; teeth pointed, in more than one series, the outer enlarged and canine-like; peritoneum pale. Dorsal slightly in advance of anal, its origin midway between tip of caudal and anterior rim of orbit, or about midway between base of caudal and opercular opening; anal small, its longest rays 1½ in head.

Color in alcohol, olivaceous, profusely sprinkled or dusted all over except on breast with very fine brown punctulations, so abundant on back as to obscure the individual specks; median line of back with a black stripe from occiput to dorsal fin; sides with 10 to 12 or more brown spots of larger size, these sometimes arranged somewhat definitely in two longitudinal lines, in the upper one of which the spots are confluent in some examples, forming large, oblong blotches; all the fins except the ventrals with numerous very small brown specks.

This species resembles *Z. jenkinsi*, but differs from it in the larger dorsal, much smaller anal, smaller scales, the much shorter snout, the heavier or broader head, and in the coloration. The localities from which the types were obtained would indicate that it is an inhabitant of water that is but little brackish or almost fresh.

26. Zygonectes jenkinsi, sp. nov. (Pl. XXXVI.)

This species is based upon 21 specimens, ranging in length from 1½ to 2⅛ inches, collected in Dickinson Bayou, near Dickinson, Texas, November 14, 1891, and 11 examples from Galveston Bay, Galveston, Texas, collected a day or two earlier.

Head, 3½; depth, 4½ (4⅕ to 5); eye, 3½ (3⅕ to 3⅗); D. 8 or 9; A. 12 (11 to 13); scales, 33–10, 18 before the dorsal. Body moderately elongate, head depressed, wide between the eyes, pointed, the snout about one-fourth greater than eye, which is contained 1½ times in interorbital width; mouth rather large, little oblique; teeth in more than one series, the outer enlarged, pointed, and slightly curved inward; humeral scale small, three rows of scales on cheek. Fins medium, dorsal slightly behind anal, midway between tip of caudal and posterior rim of orbit, the distance from tip of snout to origin of dorsal being twice the distance from that point to base of caudal fin; dorsal and anal low, their longest rays half length of head; base of anal 2½ in head; pectorals 1¾ in head; ventrals short, 1½ in pectoral; caudal fin truncate, about as long as head; peritoneum black.

Color, pale olivaceous, covered except on breast with numerous minute dark-brown specks, arranged chiefly along the edges of the scales, thus giving the sides and back a checkered or cross-hatched appearance; in addition to these fine punctulations, there are usually 15 to 30 larger spots more or less definitely arranged in two rows lying along or above the axis of the body; in some examples these spots are absent or blended so as to form short, indistinct vertical bars; in most specimens there is a very obscure lateral band about one scale in width; fins plain or with few very minute punctulations; top of head dark.

Related to *Z. rubrifrons* Jordan, but differing from it in the following particulars: The body is more slender, the head is shorter, the dorsal and anal are larger, and the color markings are quite different. Compared with specimens of *Z. henshalli* Jordan, it is more slender, the snout is longer and more pointed, and the color is not the same; from specimens of *Z. cingulatus* Cuv. and Val. from Pensacola, the differences are seen to be about the same as those which distinguish it from *Z. henshalli;* from the types of *Z. auroguttatus* Hay, it differs chiefly in the greater number of anal rays and the less distinct crossbars.

I name this species for Prof. O. P. Jenkins, of Leland Stanford Junior University, in recognition of his work upon the fishes of the Sandwich Islands.

27. **Zygonectes notatus** (Raf.).

Specimens of this widely distributed species were obtained at the following places:

Neches River, east of Palestine	27
Trinity River, at Magnolia Point	2
Long Lake, near Magnolia Point	15
Buffalo Bayou, Houston	7
Big White Oak Bayou, Houston	23
San Antonio Springs, San Antonio	5

These Texas specimens do not differ apparently from examples collected in Indiana.

28. **Zygonectes escambiæ** Bollman.

Zygonectes escambiæ Bollman, Proc. U. S. N. M. 1886, 463 (Escambia River, Flomaton, Ala.).

From a pond on the bank of the Trinity River, at Magnolia Point, we obtained 5 specimens that I refer to this species.

Head, 4; depth, 5; eye, 2¾, greater than snout; scales about 38–10, 20 before the dorsal; dorsal, 7 or 8, slightly behind the anal; anal, 9. Sides with about 10 brownish or chocolate lines made up of a spot on each scale; in two of the five examples these lines are more nearly continuous than in the others; between these are smaller spots hardly forming lines; the individuals with the spots most distinct are probably males.

Compared with the types of *Z. escambiæ*, these specimens are more slender, the spots come nearer to forming continuous bands, and the fins are all plain, compared with the types of *Z. craticula* Goode and Bean, which are from Indian River, Florida; the snout is shorter and less pointed, the lower jaw projects less, and the longitudinal lines are less marked. Specimens of *Z. craticula* collected at Titusville, Florida, by Mr. R. E. Earll, show about 10 dark crossbars not developed on any of the other specimens examined except on one collected at Westville, Florida, by Dr. O. P. Hay, and identified by him as the *Z. nottii* of Agassiz. *Zygonectes escambiæ* Bollman closely resembles *Z. craticula* Goode and Bean, and it may be that they are both identical with *Z. nottii* Ag. The briefness of Agassiz's description of *Z. nottii* makes it very difficult to identify that species with certainty, and it is perhaps best to let the names stand as above.

29. **Lucania parva** (B. and G.).

Cyprinodon parvus Baird and Girard, 9th Smithsonian Report, for 1854, 345 (Greenport, Long Island).

One specimen of this interesting little fish was taken in Sims Bayou, at Houston, 3 in Dickinson Bayou, 4 in San Antonio Springs, and 4 at Corpus Christi.

This species at first glance much resembles *Gambusia patruelis*, and, in collecting, is apt to be mistaken for that species.

30. Gambusia patruelis (B. and G.).

Heterandria patruelis Baird and Girard, Proc. Acad. Nat. Sci. Phila. 1853, 390.

Gambusia gracilis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121 (Matamoras).

Gambusia humilis Günther, Cat. Fish., VI, 335, 1866 (Matamoras).

Haplochilus melanops Cope, Proc. Amer. Phil. Soc. 1870, 457 (Neuse River).

Zygonectes atrilatus Jordan and Brayton, Bull. U. S. N. M., XII, 84, 1878 (Neuse River, North Carolina.)

Zygonectes brachypterus Cope, Jordan and Gilbert's Synopsis, 341, 1882 (Trinity River and other streams of Texas).

This species is represented in the collection from Texas by the following specimens:

Neches River, east of Palestine	1
Trinity River at Magnolia Point	2
Long Lake, near Magnolia Point	2
Buffalo Bayou, Houston	8
Hunter Creek, Houston	10
Kilper's Ponds, Houston	38
Big White Oak Bayou, Houston	5
Sims Bayou, Houston	48
Dickinson Bayou, Dickinson	36
San Antonio Springs, San Antonio	15
Comal Creek, New Braunfels	127
Rio San Marcos, San Marcos	68

All the specimens from the first seven localities show the dark suborbital spot very distinctly. All the specimens from Sims Bayou are very pale and there is no suborbital spot in any of them, but all the fishes gotten from this place present a bleached appearance, due, no doubt, to the character of the water in which they were found, which was a muddy and foul pool left by the drying up of the greater part of the stream. Of the specimens obtained from Dickinson Bayou, 4 show the spot while the others are plain. All these specimens were also quite pale. The 15 specimens from San Antonio are quite dark, and the majority show the dark suborbital spot. The majority of the numerous specimens from New Braunfels show the spot, though in some it is quite faint and in others it is wholly absent. All these specimens are quite dark and resemble those from San Antonio. Those from San Marcos are rather pale and but few of them show the suborbital spot.

There do not seem to be any good reasons for separating *G. humilis* from *patruelis*, even as a geographical form.

In many of the female specimens from San Antonio and New Braunfels the embryos are quite large, fully ¼ inch in length, showing that the species produces its young in midwinter in southern Texas. Specimens collected by Dr. Hugh M. Smith, at St. George Island, Maryland, July 1, contained immature eggs, while others collected at the same place by him August 11 contained young apparently ready for extrusion.

31. Mollienesia latipinna Le Sueur.

One specimen of this attractive species was taken at Corpus Christi, 2 at Galveston, 42 at Dickinson Bayou, and 1 from Hunter Creek, near Houston.

LIST OF CRUSTACEA COLLECTED.

[By Mary J. Rathbun, Department of Marine Invertebrates, National Museum.]

The collection of Crustacea of which a list is given below was made by Prof. B. W. Evermann, of the U. S. Fish Commission, during the months of November and December, 1891, while engaged in an investigation of the fresh and salt waters of eastern Texas, with a view to the establishment of a hatchery. While the collection contains no new species, it is interesting from the fact that it extends the limits of many species and furnishes new localities for others. Those species which have not been hitherto recorded from a locality so far south, are as follows: *Panopeus depressus*, *Callinectes hastatus*, *Tozeuma carolinensis*, *Palæmonetes vulgaris*, *Palæmonetes exilipes*, *Palæmon ohionis*. *Hippa emerita* (not *talpoida* Say) has not been found further north than Cuba and Mexico. The species whose range includes Texas but which have not been previously recorded from there, are *Libinia dubia*, *Panopeus herbstii*, *Arenæus cribrarius*, *Petrolisthes armatus*, *Alpheus heterochælis*, and *Squilla empusa*.

BRACHYURA.

1. **Libinia dubia** Milne-Edwards.

Corpus Christi; Shamrock Point, Corpus Christi.

2. **Panopeus herbstii** Milne-Edwards.

Galveston Bay.

3. **Panopeus texanus** Stimpson.

Shamrock Point, Corpus Christi.

4. **Panopeus depressus** Smith.

Galveston Bay.

5. **Callinectes hastatus** (Say).

Galveston Bay; jetty, Galveston; Swan Lake, Galveston; Corpus Christi; Shamrock Point, Corpus Christi; Dickinson Bayou. The specimens are all small, except one large male from Galveston Bay.

6. **Arenæus cribrarius** (Lamarck).

Corpus Christi Bay.

7. **Sesarma cinerea** (Bosc).

Swan Lake, Galveston.

ANOMURA.

8. **Petrolisthes armatus** (Gibbes).

Galveston Bay.

9. **Hippa emerita** (Linné ?) Fabricius.

Galveston Bay; Swan Lake, Galveston. Easily distinguished from *talpoida* by the following characteristics: The median lobe of the front is more triangular; the lateral lobes much longer and narrower. Second joint of outer antennæ with the median spine very long, much exceeding the eyes, directed slightly outward; while in *talpoida* the spine is much shorter and directed inward. Third joint of outer maxillipeds longer and narrower than in *talpoida*, the inner margin being straight or slightly concave for its anterior two-thirds instead of convex as in *talpoida*; the lobe at the antero-internal angle much longer. In the specimens under discussion the terminal joint of the third pair of legs is lanceolate, but this is not characteristic of the species.

MACRURA.

10. **Tozeuma carolinensis** Kingsley.

Shamrock Point, Corpus Christi.

11. **Alpheus heterochælis** Say.

Galveston Bay; jetty, Galveston Bay.

12. **Palæmonetes vulgaris** (Say).

Galveston Bay; Swan Lake, Galveston; Corpus Christi; Dickinson Bayou. The specimens agree in having the tip of the rostrum devoid of spines.

13. **Palæmonetes exilipes** Stimpson.

Neches River, fourteen miles east of Palestine; Magnolia Point, Trinity River; Kilper's Pond, Houston; Big White Oak Bayou, two miles south of Houston; Corpus Christi. While as a rule the rostrum has seven or eight teeth above and two below, one specimen has nine above and three below, and several specimens with eight above have three below. The single specimen from Corpus Christi is the only one in which the rostrum exceeds the antennal scales.

14. **Palæmon ohionis** Smith.

Long Lake, Palestine; Magnolia Point, Trinity River; Big White Oak Bayou, two miles south of Houston.

15. **Penæus setiferus** (Linné).

Galveston Bay; jetty, Galveston Bay; Swan Lake, Galveston; Corpus Christi.

16. **Penæus brasiliensis** Latreille.

Galveston Bay; Swan Lake, Galveston; Corpus Christi Bay; Corpus Christi.

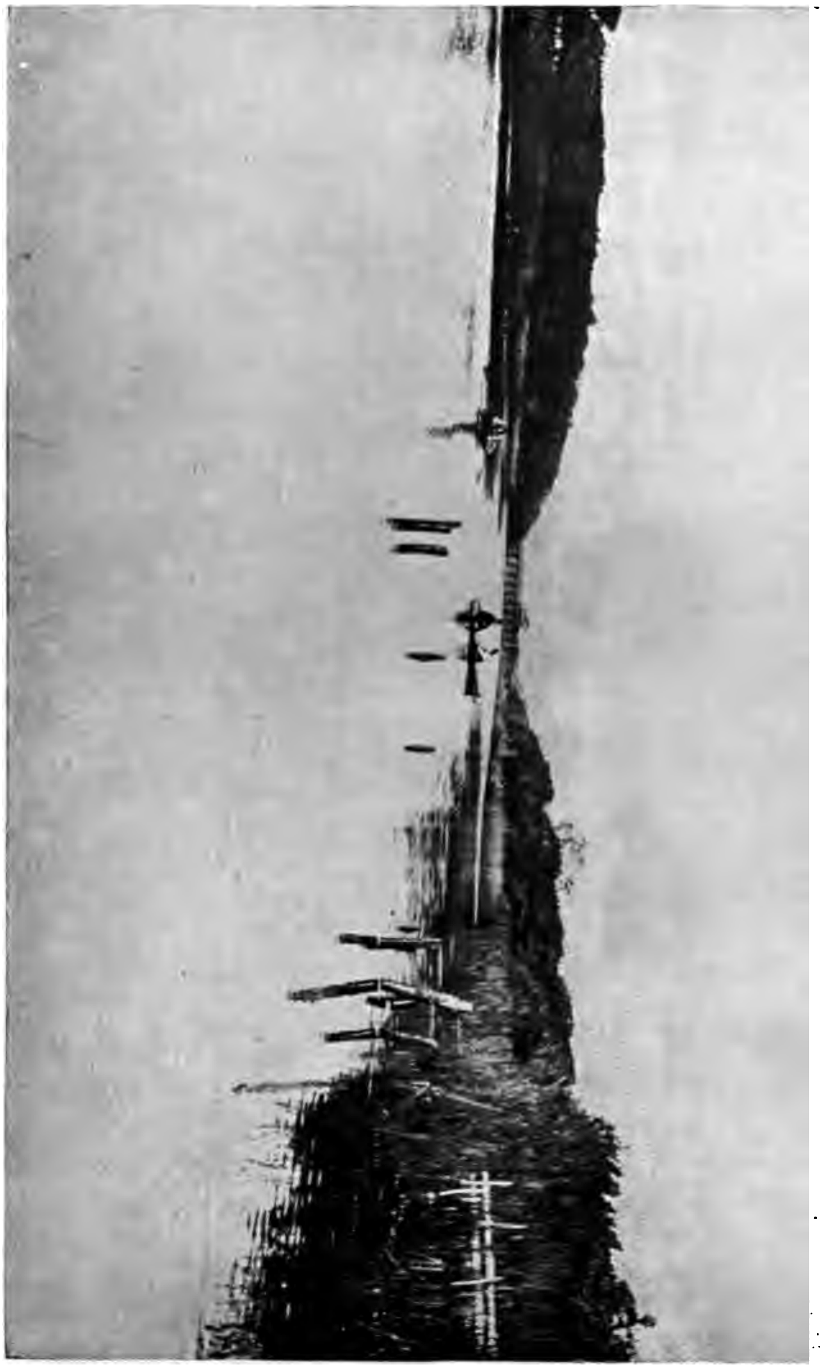
17. **Cambarus clarkii** Girard.

Swan Lake, Galveston. One young male.

STOMATOPODA.

18. **Squilla empusa** Say.

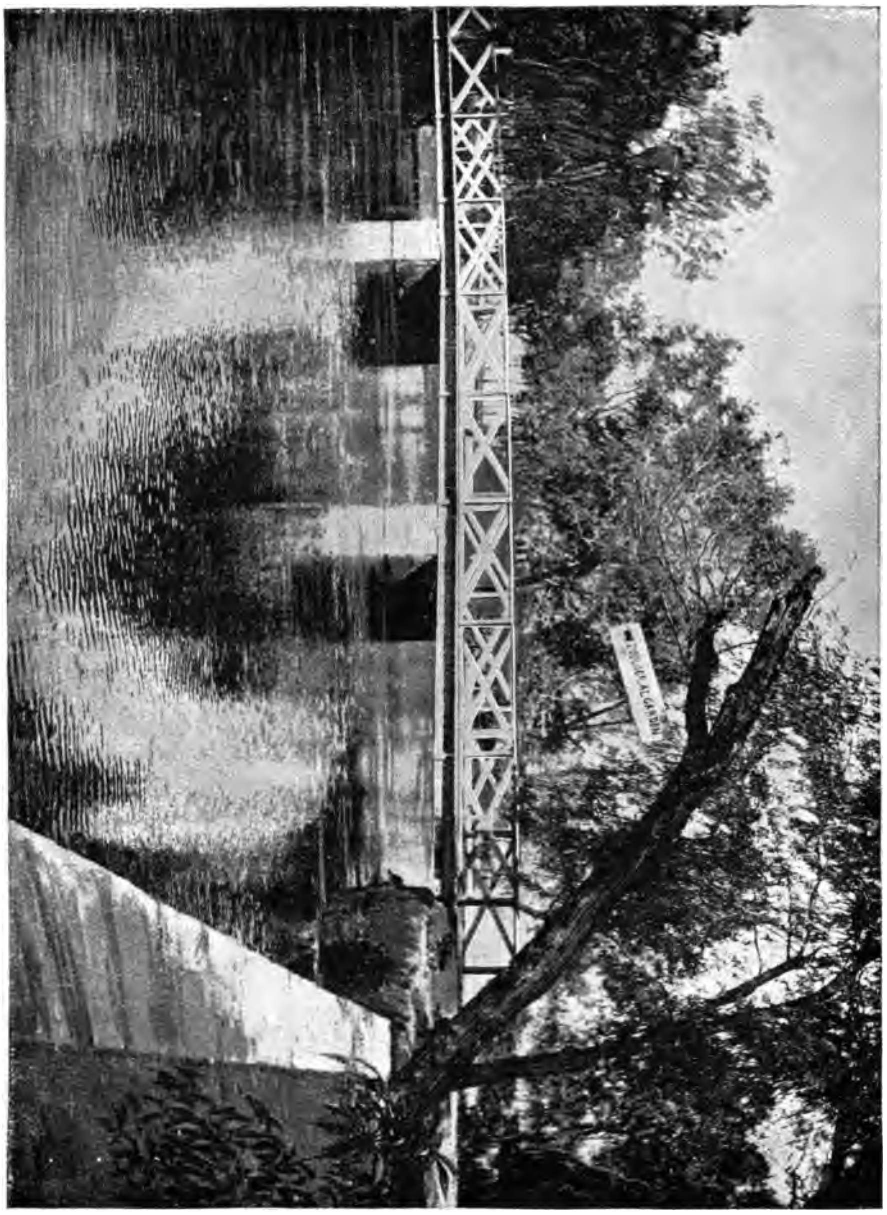
Jetty, Galveston Bay.



DICKINSON BAYOU, UPSTREAM FROM NICHOLSTONE; DICKINSON, TEXAS

PLATE XXX.

TRINITY RIVER NEAR MAGNOLIA POINT, TEXAS.

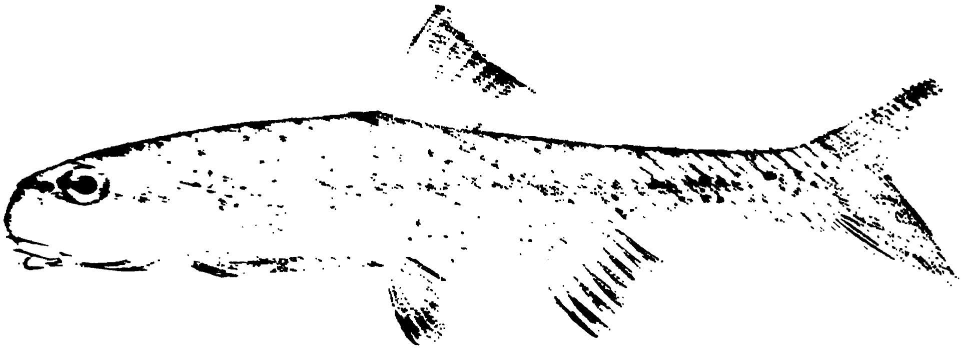


FISH POND AT SAN PEDRO SPRINGS, SAN ANTONIO, TEXAS.

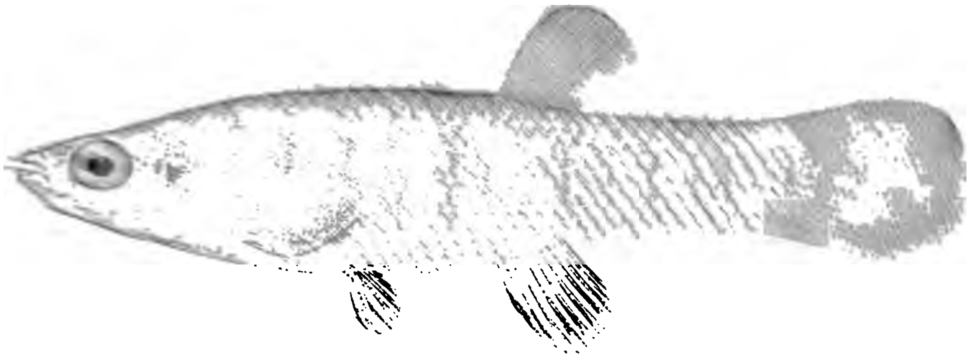
SAN MARCOS RIVER AT THE MILL, SAN MARCOS, TEXAS.

SAN MARCOS SPRING, SAN MARCOS, TEXAS.

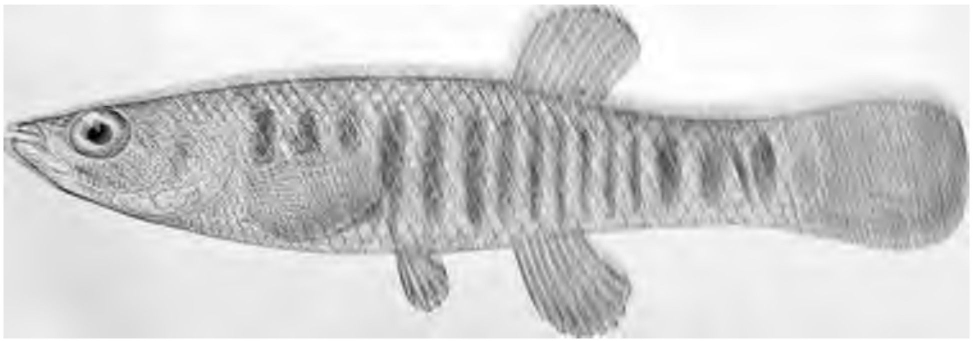
SAN MARCOS SPRING, SAN MARCOS, TEXAS. [illegible]



1. HYBOPSIS ÆSTIVALIS MARCONIS, [illegible]

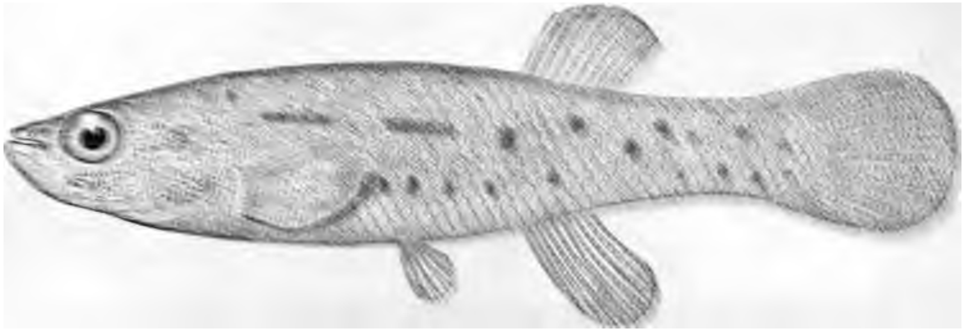


2. FUNDULUS PALLIDUS, sp. nov. About three times natural size.

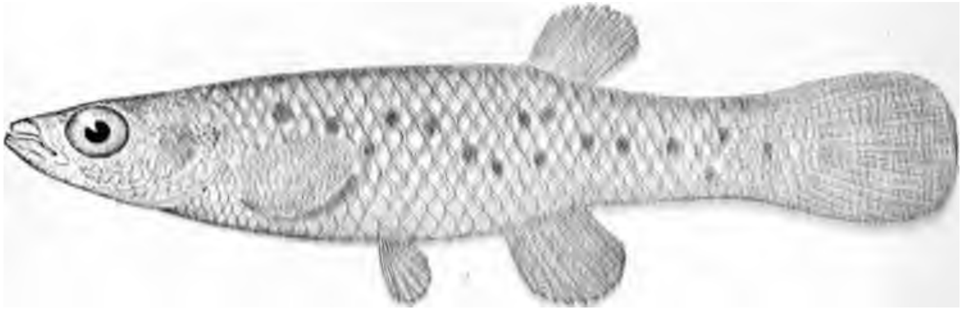


3. ZYGONECTES FUNDULOIDES, sp. nov. About three and a half times natural size.

Bull. U. S. F. C. 1891. Fish-cultural Investigations in Texas. (To face page 90—9.) PLATE XXXVI.



1. ZYGONECTES PULVEREUS, sp. nov. About three times natural size.



2. ZYGONECTES JENKINSI, sp. nov. About three times natural size.

3.—REPORT ON THE FISHERIES OF THE GULF STATES.

INTRODUCTORY.

The following report upon the fisheries of the Gulf States, prepared in the Division of Fisheries of the U. S. Fish Commission, will, it is believed, prove acceptable and instructive to all directly or indirectly interested in the fishery resources of the Gulf of Mexico.

The value of the fishery products of this region is at present small when compared with the great fisheries of the New England States, where experience and enterprise, combined with intelligent and systematic methods, have greatly developed the resources of the waters. This report discloses, however, great possibilities of future production in the waters of our southern borders, and shows that large additions can be made to the wealth of this region by industry and enterprise, so that we may well hope the time is not far remote when these fisheries will command the attention they deserve. The inquiry prosecuted has been addressed to every phase of the commercial fisheries of the Gulf States, covering their methods and relations as well as the statistics of their production and value. As this report is general in character and covers the entire Gulf region, the information conveyed has in some particulars necessarily been restricted. It is the intention of the Commission, however, to publish, from time to time, papers dealing with the fisheries of each of the States, which will give more in detail their condition and extent, the possibilities for their improvement, and the advantages they offer to capitalists by their systematic prosecution.

The preparation and form of presentation of this report have been under the general direction of Mr. J. W. Collins, assistant in charge of the Division of Fisheries, aided by Dr. Hugh M. Smith, principal assistant, by whom the explanations and discussions of the tables have been mainly made. The data on which the report is based were chiefly collected by Messrs. W. H. Abbott, Ansley Hall, Edward E. Race, and C. H. Stevenson, field agents of the division.

MARSHALL McDONALD,
Commissioner.

A STATISTICAL REPORT ON THE FISHERIES OF THE GULF STATES.

BY J. W. COLLINS AND HUGH M. SMITH.

I.—GENERAL NOTES AND STATISTICS.

The geographical and natural advantages of the Gulf coast.—The Gulf region has a coast line very much longer than that of any other geographical division of the coast States. Taking into consideration the principal indentations, its approximate length is 6,875 miles, while the Middle Atlantic States, which rank next in this respect, have only 5,400 miles of coast, including the rivers to the limits of commercial fishing. The shores of this entire section are low, and for the most part sandy and swampy, sterile sandy beaches and shallow bayous being characteristic features of the coast.

The Gulf States occupy a favorable location for supplying a large part of the country with marine products. A dozen or more States in the lower Mississippi Valley have their nearest coastal connections through these States, and it will probably be in response to this section's demand for marine food-products that the Gulf fisheries will reach their highest development.

This region is favored with many highly esteemed food-fishes, which occur here in greater abundance than elsewhere on the coasts of the United States; among these the sheepshead, pompano, red snappers, and groupers may be mentioned, while certain important products may be said to be peculiar to the region. The undeveloped resources of the Gulf States invite outside attention and afford a promising outlook for future increase. The possibilities of the region in the matter of oyster production and cultivation are believed to be great, though there are in some localities certain difficulties to be encountered and natural limitations which may somewhat retard rapid development.

The fisheries of this region are not specially important when compared with those of some other geographical divisions of the coast States. Nevertheless, though the New England, the Middle Atlantic, and the Pacific States have much larger fishing interests, the Gulf fisheries are remarkable for their recent wonderful growth and for the possibilities of greater advancement in the future. It is noteworthy that in recent years they have surpassed both in extent and value the fisheries of the South Atlantic region.

Investigation of the Gulf fisheries.—In conformity with the prescribed functions of the Division of Fisheries of the U. S. Fish Commission, an investigation of the fishing industry of the coastal waters of this interesting region was undertaken in the early part of 1891, and covered a period of about three months. The inquiry embraced every phase of the commercial fisheries, including the history, methods, relations, and statistics, and was conducted by the following field agents of the Commission: W. H. Abbott, Ansley Hall, Edward E. Race, and Charles H. Stevenson. The fishermen, fish-dealers, and canners, and the general business public of this region evinced a lively interest in the work, and extended every facility to aid the canvass of the field agents.

Scope of the report.—In this paper it is intended to present a statistical review of the commercial coast fisheries of the States bordering on the Gulf of Mexico. The descriptive matter is intentionally brief, and consists for the most part simply of a discussion of the tables. In the introductory portion of the report the States are considered in relation to each other and to the region as a whole; while the chapters which relate to the separate States give detailed accounts of the various phases of the fisheries. The figures in the general tables show the condition of the fisheries in 1890; the statistics under each State are for two years, 1889 and 1890, and are therefore valuable because of the comparisons permitted.

The report treats of the fisheries of only the Gulf coast of Florida, but in the special chapter on that State condensed figures are given for the east coast.

It is the intention of the Fish Commission to publish, from time to time, separate papers dealing with the fisheries of each of the Gulf States. The absence of full information on the development, methods, relations, etc., of these fisheries is very apparent and must necessarily delay the advancement of the industry. The fisheries of no other section of the United States have received less attention and are so little understood, and it is thought that detailed reports of their present condition and extent, the advantages they offer to capitalists, and the possibilities for their improvement will greatly enhance their importance.

The hunting of alligators constitutes an important fishery enterprise in some of the States of this region, notably Florida and Louisiana. As much the larger number of animals are killed at points distant from the coast, usually in more or less inaccessible regions, no complete investigation of this branch was made. The statistics obtained relate only to the region on or immediately adjacent to the coast, and are not included in the regular tables, but are given in the form of footnotes under each State.

The fishermen.—A large number of nationalities are represented among the fishermen of the Gulf States. There is no section of the eastern United States in which so many unnaturalized persons are found in the fisheries. More foreign fishermen are credited to Louisiana than to any other State; here nearly one-third of the fishing population is made up of aliens, chiefly Italians, Austrians, Malays, Spaniards, and French. In the number of foreign fishermen Florida ranks next to Louisiana, having only a few less; the British provincial element predominates, a large number of both white and colored persons from the Bahama and other British islands being represented; Spaniards, Italians, Portuguese, Norwegians, and Greeks also occur in considerable numbers, the non-naturalized fishermen being between one-fourth and one-third the fishing population. The remaining States have only a small number of foreign fishermen, who are chiefly from the countries of southern Europe, Spain furnishing the largest number. Taking the Gulf region as a unit, it is seen that the fishermen who are citizens of the United States constitute 76 per cent of the fishing population, while the remaining 24 per cent is composed of foreigners. The percentage of colored persons among the native and naturalized fishermen is about 22, Florida having the most and Texas the fewest. The actual number of American white and colored persons and of aliens employed in the fisheries is shown in Table 4, under the head of "Statistics of the fisheries"; under each State this information is also given in greater detail.

The apparatus of capture.—By referring to the tables under the individual States, it will be seen that the haul seine is the most extensively used device in taking fish proper; it is so generally employed in all the States—in some of them almost to the exclusion of other forms—that it may be called the characteristic means of capture in the Gulf region. The gill net is an unimportant form of apparatus except in Florida, where it yields larger results than the seine. Such minor devices as the cast net and dip net are mostly employed by semi-professional fishermen and take but small quantities of fish; they are most commonly used in Louisiana.

Both in Florida and Louisiana lines constitute a very prominent means of capture; in the former State they take larger quantities of fish proper than any other kind of apparatus.

Such implements as are used in the oyster, sponge, and similar fisheries, in addition to being the least expensive, are naturally the most productive. In every State but Texas they yield much larger returns than any of the other forms of apparatus and in Florida give greater results than all other kinds combined.

The entire absence from the Gulf States of pound nets, trap nets, weirs, and fyke nets, which are so prominent in the fisheries of other portions of the United States coast, is one of the most noticeable features of the fishing industry of this region. Pound nets have been tried at Pensacola, Florida, and elsewhere, but their use has never passed beyond the experimental stage, owing to the natural disadvantages which have heretofore seemed almost insurmountable. The objections to the use of the pound net, trap net, and similar devices may be briefly summarized:

1. The waters of the Gulf of Mexico abound in large, predaceous fish, which were found to enter the pound nets through the door or opening and often made their exit through the netting, generally tearing such large holes in the sides of the trap that all the other fish escaped. Aside from the liberation of the catch, the actual damage to the net was often great. Sharks, tarpon, alligator gars, and jewfish caused the most damage.

2. The teredo is abundant, and is very destructive to the poles, which constitute an important element of expense in building pound nets.

3. The high temperature of the water in this subtropical region exerts a destructive influence on twine, which becomes rotten much more rapidly than in Northern waters.

The possibility of overcoming all these difficulties may be suggested. It is thought that a pound net may be constructed of galvanized iron wire, which will not only withstand the attacks of large fish, but will capture them for food, bait, and fertilizer. Of course such a net can not be handled in the same way an ordinary pound net is drawn, but several other methods of taking the fish from the net are believed to be practicable, such as the use of a small seine, as in the herring weir fishery in Maine, or the arrangement of the bowl so that it may be raised and lowered by means of pulleys. A false bottom of wire or twine would also be used. The employment of hollow galvanized iron stakes instead of wooden poles is entirely feasible as a protection from the teredo and would ultimately be the more economical practice.

It may be stated here that one of the reasons why gill nets are not more extensively used in this section is the abundance of crabs, garfish, and numerous other species which do no great direct injury to the nets, but are always present to attack and destroy the fish that are gilled.

The importance of the various devices employed in the fisheries of this region, as determined by the value of the products taken, is shown in Table 1. The catch in seines was valued at $658,764; with lines, at $289,209; in gill nets and trammel nets, $219,333; in cast nets and dip nets, $23,286; and with miscellaneous apparatus, as tongs, spears, sponge hooks, etc., at $1,248,083.

1.—Table showing by States the value of the fish and other aquatic products taken with each principal form of apparatus in 1890.

States.	Seines.	Lines.	Gill nets and trammel nets.	Cast nets and dip nets.	Miscellaneous apparatus.	Total.
Florida	$149,604	$194,036	$183,686	$3,298	$534,115	$1,064,139
Alabama	24,090	3,095	18,862	1,012	107,812	154,871
Mississippi	68,793	249	9,185	800	166,672	245,699
Louisiana	259,065	78,139	....	14,636	308,294	660,134
Texas	157,812	13,690	7,600	3,540	131,190	313,832
Total	658,764	289,209	219,333	23,286	1,248,083	2,438,675

The vessels.—The following table shows by States, rigs, tonnage, etc., the statistics of the vessels employed in the Gulf fisheries. In some respects the fishing fleet of this region differs from that employed in other sections of the United States, although it is true that here, as elsewhere, schooners are more universally employed in the fisheries than any other class, and in Florida a large number of the fleet are northern-built craft. This applies more particularly to the vessels employed in the red-snapper and grouper fisheries, which are generally typical New England schooners, though usually of comparatively small size. But while these are generally deep-keel vessels, the greater number of the schooners employed in the oyster and sponge fisheries are shallow, center-board craft, many of them being built in this region for the special trade in which they are employed.

Steam has not yet become an important factor in the fisheries of this region. In Florida it has recently been employed to a limited extent, two small steamers being used chiefly for transporting the catch of fishing gangs to market. Two steamers are employed for a similar purpose in Louisiana and one in Texas.

The sloop rig is still in favor for sailing vessels of comparatively small tonnage. These sloops are mostly wide, shallow, center-board vessels; and it may be remarked that the general character of the coast necessitates the employment of craft with light draft. This is emphasized by the recent employment of large sharpies about Tampa, Florida, averaging 7 or 8 tons burden.

The Gulf region is remarkable for the employment of a large number of small lug-rigged vessels of about 7 tons register. These are mostly found in Louisiana, which has 86 vessels of this class in a total of 88 for the entire section. The typical lugger is a sharp, shallow, center-board craft, carrying a single large lugsail. Vessels of this rig are celebrated for speed and general fitness for the work they have to perform. They are manned chiefly by fishermen of foreign birth.

2.—Table showing by States the rigs of vessels employed in the fisheries of the Gulf region in 1890.

States.	Steamers.		Schooners.		Sloops.		Luggers.		Sharpies.		Total.	
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
Florida	2	34.40	149	2,499.36	12	80.62	....	....	3	22.50	166	2,636.88
Alabama	....	....	31	334.79	7	53.08	....	....	....	....	38	387.87
Mississippi	....	....	55	519.71	5	33.89	2	16.42	....	....	62	570.02
Louisiana	2	54.49	24	232.01	7	42.29	86	568.05	....	....	119	896.84
Texas	1	88.17	9	92.44	9	60.15	....	....	....	....	19	240.76
Total	5	177.06	268	3,678.31	40	270.03	88	584.47	3	22.50	404	4,732.37

The products of the fisheries.—Few sections of the United States are better supplied with desirable and important marine fishery products, including fish, reptiles, and invertebrates, than the Gulf States. Among the invertebrates, the oyster ranks first in commercial importance. It is extremely abundant throughout the entire section and constitutes the most prominent fishery product. No other mollusks have as yet attained economic prominence, though in Florida the round clam or quahog is taken in small quantities, and the meat of the conch is used for bait and eaten locally.

A number of species and varieties of sponges occur off the Florida coast and are objects of an important fishery, the only one of the kind prosecuted from the United States. The principal species taken are known as the grass, yellow, velvet, glove, and sheepswool sponges, the poorest and least valuable of which are the glove and grass sponges, while the sheepswool occupies the first rank among American sponges and is the species most eagerly sought.

Among crustaceans the shrimp is the most prominent. It is taken on the coasts of Mississippi, Texas, and Louisiana, the last-named State maintaining the most extensive fishery. The shrimps are eaten fresh, and are also preserved by drying and canning. Crabs are abundant in this region; in addition to the common blue or edible crab of the Atlantic coast, there occur the shore crab, the lady or sand crab, and other species of less importance. The fishermen of Louisiana secure larger quantities of crabs than those of Mississippi and Texas, the only other Gulf States in which the fishery is carried on. The stone crab, which reaches a large size and is very palatable, is probably most abundant on the coast of Florida, where it is a highly esteemed food among the coast inhabitants, but is not sought for commercial purposes. The lady crab is very common in Louisiana waters, and is a favorite product in New Orleans. Several species of crayfish exist in the brackish and fresh waters of the Gulf region, but it is only in Louisiana that they are caught for market. In April, 1890, an experimental attempt was made by the U. S. Fish Commission to acclimatize the lobster in the Gulf of Mexico; 745 adult male and female lobsters and 250,000 eggs were planted in Galveston Bay, but the fresh water of the bay proved fatal to the adults and it is not probable that the eggs hatched. In southern Florida the fishermen take considerable quantities of the spiny lobster, locally called "crawfish," which are mostly used for bait and are only sparingly eaten.

The economic value of the reptiles inhabiting the Gulf States is greater than in any other section. Foremost among them is the alligator, which occurs in every State, but is of commercial importance only in Florida and Louisiana. The crocodile is also found in Florida and is occasionally though very rarely taken. There are at least five species of terrapins in this section which are valuable as food. Four of these occur in fresh water, one of which, the "mobilian," reaches a length of 16 inches and is very highly esteemed, especially in New Orleans, Mobile, and other Southern cities. The salt-water or diamond-back terrapin is also found in the salt marshes from Florida to Texas, and is a valuable object of fishery. This region is included within the range of three soft-shell tortoises, which are chiefly found in shallow, sluggish streams with muddy bottoms; both their flesh and eggs rank high as articles of food. Two species of snapping turtle also inhabit the fresh waters of these States and are sometimes captured. Three important marine turtles frequent the Gulf of Mexico and are sought by the fishermen of nearly every State; these are the green turtle, the loggerhead, and the hawkbill or tortoise-shell turtle. The loggerhead turtle often attains a weight of 1,600 pounds, but the average weight is very much less; the green turtle is intermediate in size between the loggerhead and the hawkbill.

Taking the region as a whole, the most prominent fish is the mullet, although this is relatively important only in Florida. Of the fish that are generally distributed and are taken in greater or less quantities in each State, the squeteague or trout ranks first, followed by the sheepshead and the redfish or channel bass. Other valuable fishes are the bluefish, buffalo-fish, catfish, croakers, grunts, pompano, red snapper, and Spanish mackerel. The most important of these is the red snapper; the catch exceeds that of all other species except the mullet. In addition to the foregoing there is a great variety of other species, some of which are more or less peculiar to this region, such as the minor snappers, groupers, lady-fish, whiting, drum, pinfish, sailor's choice, jurel, grunts, angel fish, sea bass, etc.

In the tables of products all objects of capture have been reduced to the common unit of a pound, in order that the aggregate weight of the products of the fisheries may be shown. Oysters, among a few other products, are rarely, if ever, marketed on this basis, and it should therefore be borne in mind in reading the tables that the quantity of oysters given represents the weight of the edible portion, of which about 7 pounds are obtained from each bushel. Footnotes to all the general tables show the yield of oysters in bushels.

A list and classification of the fishery products of the Gulf States is given in the following table. In the first column the various local names employed in this region are shown; the second column contains the scientific identification of the species; in the third column the names are given under which the products are recorded in the tabulations. Without having the actual specimens at hand for examination it would be impossible to identify with certainty all the fishes of this region by the vernacular names in use among the fishermen; some of the local names have never been recorded and are of doubtful application, while many of the common designations are borne by two or more species, which may be of widely different character. This duplication of names is not only found by comparing distant sections or different States, but exists in the same localities. On the other hand, the same species may have totally different names in different localities.

Common and scientific names of the important commercial fishes, reptiles, etc., of the Gulf States.

Local common names.	Scientific names.	Names under which tabulated.
FISH.		
Aigrette	Lachnolæmus falcatus	Sailor's choice.
Albacore	Seriola dumerili	Amber-fish.
Almicore	Do	Do.
Amber-fish	Do	Do.
Do	Seriola stearnsi	Do.
Amber-jack	Seriola lalandi	Do.
Angel-fish	Chætodipterus faber	Angel-fish.
Blackfish	Serranus atrarius	Sea bass.
Blanca	Leiostomus xanthurus	Spot.
Blonker	Do	Do.
Bluefish	Pomatomus saltatrix	Bluefish.
Bonefish	Albula vulpes	Lady-fish.
Do	Acanthurus cœruleus	Do.
Do	Acanthurus nigricans	Do.
Bream	Centrarchidæ (numerous species)	Bream and sunfish.
Do	Lagodon rhomboides	Pinfish.
Buffalo-fish	Ictiobus cyprinella	Buffalo-fish.
Do	Ictiobus bubalus	Do.
Do	Ictiobus urus	Do.
Do	Ictiobus velifer	Do.
Callifavor	Mugil cephalus	Mullet.
Capitaine	Lachnolæmus falcatus	Sailor's choice.
Catfish, blue	Tachysurus felis	Catfish.
Catfish, channel	Ictalurus punctatus	Do.
Catfish, flannel-mouth	Ameiurus nigricans	Do.
Catfish, gaff-topsail	Ælurichthys marinus	Do.
Catfish, great	Ameiurus nigricans	Do.
Catfish, Mississippi	Do	Do.
Catfish, sea	Ælurichthys marinus	Do.
Do	Tachysurus felis	Do.
Catfish, silver	Ictalurus punctatus	Do.
Catfish, white	Do	Do.
Cavalla	Caranx hippos	Crevalle.
Cero	Scomberomorus caballa	Kingfish.
Channel bass	Sciæna ocellata	Channel bass.
Chopa	Lagodon rhomboides	Pinfish.
Chopa blanca	Leiostomus xanthurus	Spot.
Chopa spina	Lagodon rhomboides	Pinfish.
Cobbler	Trachynotus falcatus	Pompano.
Coney	Epinephelus guttatus	Groupers.
Crevalle	Caranx hippos	Crevalle.
Croaker	Micropogon undulatus	Croaker.
Croaker, bastard	Sciæna punctata	Silver perch.
Croaker, flat	Leiostomus xanthurus	Spot.
Croaker, post	Do	Do.
Drum	Pogonias cromis	Drum, salt-water.
Drum, fresh-water	Aplodinotus grunniens	Drum, fresh-water.
Flounder	Paralichthys albigutta	Flounders.
Do	Paralichthys lethostigma	Do.
Gag	Mycteroperca microlepis	Groupers.
Gaspergou	Aplodinotus grunniens	Drum, fresh-water.
Green trout	Micropterus dolomieu	Black bass.
Do	Micropterus salmoides	Do.
Ground mullet	Menticirrus americanus	Whiting.

Common and scientific names of the important commercial fishes, reptiles, etc.—Continued.

Local common names.	Scientific name.	Names under which tabulated.
FISH—continued.		
Grouper, black	Epinephelus nigritus	Jewfish.
Do	Mycteroperca microlepis	Groupers.
Do	Mycteroperca bonaci	Do.
Grouper, Nassau	Epinephelus striatus	Do.
Grouper, red	Epinephelus morio	Do.
Grouper, yellow-fin	Mycteroperca venenosa	Do.
Grunt, black	Hæmulon plumieri	Grunts.
Grunt, boar	Do	Do.
Grunt, common	Do	Do.
Grunt, French	Hæmulon flavolineatum	Do.
Grunt, open-mouth	Do	Do.
Grunt, red-mouth	Hæmulon plumieri	Do.
Grunt, sow	Do	Do.
Grunt, striped	Hæmulon tæniatum	Do.
Grunt, yellow	Hæmulon sciurus	Do.
Guasa	Promicrops itaiara	Jewfish.
Hardtail	Caranx chrysos	Jurel.
Hind	Epinephelus drummond-hayi	Groupers.
Hind, rock	Epinephelus ascensionis	Do.
Hind, speckled	Epinephelus drummond-hayi	Do.
Hogfish	Lachnolæmus falcatus	Sailor's choice.
Horse-eye jack	Caranx latus	Crevalle.
Jack	Caranx hippos	Do.
Do	Lucius reticulatus	Pike and pickerel.
Do	Lucius vermiculatus	Do.
Jackfish	Caranx chrysos	Jurel.
Do	Caranx hippos	Crevalle.
Jack, horse-eye	Caranx latus	Do.
Jewfish	Epinephelus nigritus	Jewfish.
John Paw	Epinephelus drummond-hayi	Groupers.
Jurel	Caranx chrysos	Jurel.
Kingfish	Scomberomorus caballa	Kingfish.
Do	Scomberomorus regalis	Do.
King cero	Do	Do.
Lady-fish	Albula vulpes	Lady-fish.
Lawyer	Lutjanus caxis	Snappers, gray and others.
Mademoiselle	Sciæna punctata	Silver perch.
Menille	Mugil cephalus	Mullet.
Molly	Do	Do.
Moonfish	Chætodipterus faber	Angel-fish.
Mullet, blue-back	Mugil curema	Mullet.
Mullet, common	Mugil cephalus	Do.
Mullet, ground	Menticirrus americanus	Do.
Mullet, silver	Mugil curema	Do.
Mullet, striped	Mugil cephalus	Do.
Mullet, white	Mugil curema	Do.
Nigger-fish	Enneacentrus fulvus	Groupers.
Oldwife	Trachynotus glaucus	Pompano.
Palometa	Trachynotus rhomboides	Do.
Pampa	Trachynotus rhodopus	Do.
Pargo colorado	Lutjanus blackfordi	Snappers, red.
Perch	Centrarchidæ (numerous species)	Bream and sunfish.
Perch, silver	Sciæna punctata	Silver perch.
Perch, white	Aplodinotus grunniens	Drum, fresh-water.
Permit	Trachynotus rhodopus	Pompano.
Pes colorado	Sciæna ocellata	Channel bass.

Common and scientific names of the important commercial fishes, reptiles, etc.—Continued.

Local common names.	Scientific names.	Names under which tabulated.
FISH—continued.		
Pickerel	Lucius reticulatus	Pike and pickerel.
Do	Lucius vermiculatus	Do.
Pigfish	Orthopristis chrysopterus	Grunts.
Pike	Lucius reticulatus	Pike and pickerel.
Do	Lucius vermiculatus	Do.
Pinfish	Lagodon rhomboides	Pinfish.
Pintadilla	Scomberomorus maculatus	Spanish mackerel.
Pompano, common	Trachynotus carolinus	Pompano.
Pompano, gaff-topsail	Trachynotus glaucus	Do.
Pompano, round	Trachynotus rhomboides	Do.
Poisson rouge	Sciæna ocellata	Channel bass.
Porgy	Lagodon rhomboides	Pinfish.
Post croaker	Leiostomus xanthurus	Spot.
Redfish	Sciæna ocellata	Channel bass.
Rock bass	Ambloplites rupestris	Rock bass.
Rockfish	Mycteroperca venenosa	Groupers.
Do	Roccus lineatus	Striped bass.
Ronco	Micropogon undulatus	Croaker.
Ronco amarillo	Hæmulon sciurus	Grunts.
Ronco grande	Hæmulon plumieri	Do.
Ronker	Micropogon undulatus	Croaker.
Runner	Caranx chrysos	Jurel.
Do	Elagatis bipinnulatus	Shoemaker.
Sac-à-lait	Pomoxis annularis	Bream and sunfish.
Sailor's choice	Lachnolæmus falcatus	Sailor's choice.
Schoolmaster	Lutjanus caxis	Snappers, gray and others.
Do	Lutjanus jocu	Do.
Sea bass	Serranus atrarius	Sea bass.
Sea-kitten	Ælurichthys marinus	Catfish.
Sea perch	Leiostomus xanthurus	Spot.
Sheepshead	Archosargus probatocephalus	Sheepshead.
Shiner	Lagodon rhomboides	Pinfish.
Shoemaker	Elagatis bipinnulatus	Shoemaker.
Silver-fish	Sciæna punctata	Silver perch.
Silver perch	Do	Do.
Skipjack	Albula vulpes	Lady-fish.
Do	Caranx chrysos	Jurel.
Do	Elagatis bipinnulatus	Shoemaker.
Snapper, black	Lutjanus caxis	Snappers, gray and others.
Snapper, dog	Lutjanus jocu	Do.
Snapper, gray	Lutjanus caballerote	Do.
Do	Lutjanus caxis	Do.
Do	Lutjanus griseus	Do.
Snapper, lone	Lutjanus synagris	Do.
Snapper, mangrove	Lutjanus caballerote	Do.
Do	Lutjanus griseus	Do.
Snapper, red	Lutjanus blackfordi	Snappers, red.
Do	Lutjanus campechianus	Do.
Snapper, yellow-tail	Ocyurus chrysurus	Snappers, gray and others.
Spadefish	Chætodipterus faber	Angel-fish.
Spanish mackerel	Scomberomorus maculatus	Spanish mackerel.
Spot	Leiostomus xanthurus	Spot.
Sunfish	Caranx crinitus	Crevalle.
Do	Centrarchidæ (numerous species)	Bream and sunfish.
Tallowag	Serranus atrarius	Sea bass.
Tallywag	Do	Do.

Common and scientific names of the important commercial fishes, reptiles, etc.—Continued.

Local common names.	Scientific names.	Names under which tabulated.
FISH—continued.		
Tambour	*Pogonias cromis*	Drum, salt-water
Trout, fresh-water	*Micropterus dolomieu*	Black bass.
Do	*Micropterus salmoides*	Do.
Trout, green	*Micropterus dolomieu*	Do.
Do	*Micropterus salmoides*	Do.
Trout, salt-water	*Cynoscion maculatum*	Trout.
Do	*Cynoscion nothum*	Do.
Trout, sand	Do	Do.
Trout, sea	*Cynoscion maculatum*	Do.
Trout, speckled	Do	Do.
Trout, spotted	Do	Do.
Trout, white	*Cynoscion nothum*	Do.
Warsaw	Epinephelus nigritus	Jewfish.
Whiting	Menticirrus americanus	Whiting.
Whiting, surf	Menticirrus littoralis	Do.
Yellow-jack	Caranx bartholomæi	Crevalle.
Yellow-tail	Elagatis bipinnulatus	Shoemaker.
Do	Sciæna punctata	Silver perch.
REPTILES.		
Cooter	Pseudemys concinna	Terrapins.
Mobilian	Pseudemys mobiliensis	Do.
Terrapin, fresh-water	Pseudemys concinna	Do.
Do	Pseudemys elegans	Do.
Do	Pseudemys hieroglyphica	Do.
Terrapin, diamond-back	Malaclemmys palustris	Do.
Terrapin, salt-water	Do	Do.
Tortoise, soft-shell	Aspidonectes asper	Do.
Do	Aspidonectes emoryi	Do.
Do	Aspidonectes ferox	Do.
Turtle, alligator	Macrochelys lacertina	Turtles.
Turtle, green	Chelonia mydas	Do.
Turtle, hawkbill	Eretmochelys imbricata	Do.
Turtle, loggerhead	Thalassochelys caretta	Do.
Turtle, snapping	Chelydra serpentina	Do.
Do	Macrochelys lacertina	Do.
Turtle, tortoise-shell	Eretmochelys imbricata	Do.
INVERTEBRATES.		
Crab, blue	Callinectes hastatus	Crabs.
Crab, lady	Platyonichus ocellatus	Do.
Crab, sand	Do	Do.
Crab, sea	Callinectes hastatus	Do.
Crab, stone	Menippe mercenarius	Do.
Crayfish	Cambarus acutus	Crayfish.
Do	Cambarus clarkii	Do.
Do	Cambarus virilis	Do.
Oyster	Ostrea virginica	Oysters.
Quahog	Venus mercenaria	Quahogs.
Shrimp	Penæus brasiliensis	Shrimp.
Do	Penæus setiferus	Do.
Sponge, glove	Spongia officinalis tubulifera	Sponges.
Sponge, grass	Spongia graminea	Do.
Do	Spongia equina cerebriformis	Do.
Sponge, sheepswool	Spongia equina gossypina	Do.
Sponge, velvet	Spongia equina meandriniformis	Do.
Sponge, yellow	Spongia agaricina corlosia	Do.
Do	Spongia agaricina dura	Do.

Statistics of the fisheries.—In 1890 there were 11,752 persons employed in the fisheries of the Gulf States; the capital invested in the industry amounted to $2,978,292; the quantity of products taken was 69,075,534 pounds; and the original value of the yield was $2,438,675. In the number of persons engaged in connection with the fisheries, Florida and Louisiana rank first, the former having 3,602 fishermen and 466 shoresmen, and the latter 3,608 fishermen and 460 shoresmen, an aggregate in each State of 4,068. Among the three remaining States, Mississippi is considerably in the lead, although Texas is credited with more fishermen; 1,721 persons devoted attention to the fisheries in Mississippi, of whom 690 were fishermen and 1,031 shoresmen, the number of the latter being actually and relatively larger than in any of the other States. Texas had 1,116 fishermen and 161 shoresmen, a total of 1,277; Alabama had 509 fishermen and 109 shoresmen, or 618 all told.

Florida takes precedence over the other States in the matter of investment, $1,369,294, or nearly half the sum devoted to the industry in the entire section, being credited to that State, after which come Louisiana with $719,876, Mississippi with $434,710, Texas with $319,122, and Alabama with $135,290. The specially prominent feature of the investment in Florida is the considerable number of vessels of relatively large size and value; in Louisiana the fleet is almost as numerous as in Florida, but the craft are much smaller and less expensive. Louisiana leads Florida in the number of boats employed in the shore fisheries, but in the latter State the value of boats is very much greater. Considering the entire region, it is interesting to observe that $590,124 was invested in vessels and their outfits, $557,257 in boats, $134,764 in apparatus of capture, $676,647 in shore property, and $1,019,500 in working capital.

The products of the fisheries are greater and more valuable in Florida than in any other Gulf State; 27,418,562 pounds of fish, mollusks, etc., worth $1,064,139, were taken in 1890. The most valuable objects of capture in the fisheries of this State are the sponges, which are not sought for in the other States of this region. After sponges come mullet, red snapper, pompano, Spanish mackerel, and turtle, in the catch of which Florida takes the lead. Louisiana follows Florida with 20,789,203 pounds, valued at $660,134. Here the most important products are oysters, shrimp, catfish, and buffalo-fish, in the output of which the State takes precedence. Texas holds third rank with 7,959,400 pounds, worth $313,832; oysters are the most valuable objects of fishery, though the output is less than in Louisiana or Mississippi. The next important species are squeteague or trout, channel bass or redfish, and sheepshead, in the catch of which Texas excels. Mississippi shows a larger quantity of fishery products than Texas, but their value is considerably less, the figures being 8,131,401 pounds, which sold for $245,699. More than half of this value represents oysters; the other prominent products are squeteague, shrimp, and redfish, which are relatively unimportant. The fishery products of Alabama in 1890 amounted to 4,776,968 pounds, worth $154,871, of which sum oysters constituted more than two-thirds. The only other important species are mullet and squeteague.

In the four following tables statistics of the fisheries of the Gulf region in 1890 are given, the specification being by States. The first table relates to persons engaged, the second to the nationalities of the fishermen, the third to the capital invested, and the fourth to the products taken.

3.—Table showing by States the number of persons engaged in the fisheries of the Gulf States in 1890.

States.	Fishermen.	Shoresmen.	Total.
Florida	3,602	466	4,068
Alabama	509	109	618
Mississippi	690	1,031	1,721
Louisiana	3,608	460	4,068
Texas	1,116	161	1,277
Total	9,525	2,227	11,752

4.—Table showing by States the nationality of persons engaged in the fisheries of the Gulf States in 1890.

States.	American, white.	American, colored.	Aliens.	Total.
Florida	2,026	799	1,243	4,068
Alabama	469	71	78	618
Mississippi	1,337	306	78	1,721
Louisiana	2,346	423	1,299	4,068
Texas	1,111	30	136	1,277
Total	7,289	1,629	2,834	11,752

5.—Table showing by States the investment in the fisheries of the Gulf States in 1890.

States.	Vessels.				Boats.		Value of apparatus of capture.	Value of shore property.	Cash capital.	Total investment.
	No.	Net tonnage.	Value.	Value of outfit.	No.	Value.				
Florida	166	2,636.88	$241,740	$144,578	2,075	$263,529	$49,640	$183,207	$486,600	$1,369,294
Alabama	38	387.87	24,700	7,110	212	17,230	11,550	29,100	45,600	135,290
Mississippi	62	570.02	36,400	12,359	257	13,395	10,485	110,771	251,300	434,710
Louisiana	119	896.84	67,650	25,877	2,578	161,533	39,138	243,178	182,500	719,876
Texas	19	240.76	25,705	4,005	814	101,570	23,951	110,391	53,500	319,122
Total	404	4,732.37	396,195	193,929	5,936	557,257	134,764	676,647	1,019,500	2,978,292

6.—Table showing by States the products of the fisheries of the Gulf States in 1890.

Species.	Florida.		Alabama.		Mississippi.		Louisiana.		Texas.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber-fish, fresh	65,000	$2,600	....	....	....	....	....	....	....	....
Angel-fish, fresh	126,726	2,005	5,168	$52	29,350	$1,019	....	....	....	....
Black bass, fresh	5,000	100	....	....	6,000	300	81,570	$4,219	....	....
Bluefish, fresh	420,046	10,398	55,760	1,213	95,900	4,595	13,050	843	25,500	$1,327
Bream and sunfish, fresh	38,088	966	19,200	960	89,100	3,609	270,020	15,682	34,700	1,526
Buffalo-fish, fresh	....	....	....	....	121,700	1,217	1,180,250	22,940	13,800	690
Catfish, fresh	....	....	37,600	940	93,400	1,794	2,674,007	54,726	45,000	2,090
Channel bass, fresh	457,737	7,236	54,464	2,242	201,300	8,757	339,316	11,270	1,107,950	47,905
Crevalle, fresh	18,024	287	10,000	351	....	....	....	....	56,350	2,241
Croakers, fresh	42,923	650	98,075	3,231	57,325	1,465	158,267	9,479	175,950	6,730
Drum, fresh-water, fresh	52,884	771	....	....	....	....	18,200	1,352	....	....
Drum, salt-water, fresh	121,853	1,836	7,000	210	3,200	160	....	....	4,000	80
Flounders, fresh	23,620	336	19,800	1,188	76,550	3,097	25,625	2,407	130,650	5,825
Groupers, fresh	398,731	4,490	11,250	225	....	....	17,800	178	....	....
Grunts, fresh	680,725	22,202	....	....	....	....	....	....	....	....
Jewfish, fresh	....	....	....	....	....	....	....	....	46,000	1,874
Jurel, fresh	314,840	3,666	31,285	473	....	....	....	....	....	....
Kingfish, fresh	291,725	12,625	....	....	....	....	....	....	....	....
Lady-fish, fresh	99,584	1,556	12,920	129	....	....	....	....	....	....
Lady-fish, salted	22,000	660	....	....	....	....	....	....	....	....
Mullet, fresh	10,650,959	113,572	587,555	13,097	305,400	3,479	287,750	8,021	83,450	2,770
Mullet, salted	2,968,254	80,184	....	....	....	....	....	....	....	....
Mullet, smoked	3,200	148	....	....	....	....	....	....	....	....
Mullet roe, salted	298,549	17,257	....	....	....	....	....	....	....	....

6.—*Table showing by States the products of the fisheries of the Gulf States in 1890*—Continued.

Species.	Florida.		Alabama.		Mississippi.		Louisiana.		Texas.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pickerel and pike, fresh			34,500	$1,035	14,750	$590			32,450	$1,402
Pinfish, fresh	52,535	$778	15,416	375	55,200	1,593				
Pompano, fresh	259,056	24,489	17,178	2,577	14,875	1,637	32,450	$4,378	2,000	600
Pompano, salted	41,300	1,870								
Rock bass, fresh							54,200	3,047		
Sailor's choice, fresh	58,277	856	2,800	98					25,850	1,204
Sea bass, fresh	5,700	136			23,660	1,065				
Sheepshead, fresh	543,797	9,449	35,114	1,314	173,200	7,870	390,817	25,906	778,800	30,871
Shoemaker, fresh									12,300	513
Silver perch, fresh	36,177	796	4,845	73			140,160	6,206		
Snappers, red, fresh	4,172,942	123,799	62,375	2,495			240,500	7,215	4,800	240
Snappers, gray and others, fresh	47,303	967								
Spanish mackerel, fresh	434,193	20,908	43,966	2,464	46,500	3,150	144,000	14,665	25,000	1,318
Spanish mackerel, salt	6,800	192								
Spots, fresh	35,315	508	25,450	606	45,885	1,375	30,600	1,520		
Striped bass, fresh							49,950	3,050	9,000	391
Trout, fresh	551,113	12.036	208,750	10,706	372,100	17,596	655,670	33,026	1,120,450	47,864
Trout, salted	51,350	1,342								
Whiting, fresh	25.242	521	4.307	65						
Miscellaneous fish, fresh	477,211	22,389					161,380	9,319	184,000	6,744
Miscellaneous fish, salt.	67,900	1,457								
Sponges	366,772	438,682								
Oysters	2,597,567	93,692	3,367,490	107,812	5,645,346	166,672	5,891,095	299,896	3,085,600	127,990
Quahogs	7,330	747								
Shrimp					613,500	12,622	6,662,050	90,519	175,800	5,670
Crayfish							140,650	7,030		
Crabs, hard					32,560	1,307	850,800	12,815	190,800	5,096
Crabs, soft					14,600	730	129,900	6,547		
Terrapins	4,180	130	4.700	940			58,333	1,543	6,200	1,532
Turtles	468,256	20,972					90,793	2,335	583,000	9,345
Turtle eggs	6,625	994								
Tortoise shell	1,153	2,884								
Total	27,418,562	1,064,139	4,776,968	154,871	8,131,401	245,699	20,789,203	660,134	7,959,400	313,832

SUMMARY.

Species.	Pounds.	Value.	Species.	Pounds.	Value.
Amber-fish, fresh	65.000	$2,600	Sailor's choice, fresh	86.927	$2,158
Angel-fish, fresh	161,244	3,076	Sea bass, fresh	29.360	1.201
Black bass, fresh	92,570	4,619	Sheepshead, fresh	1,921.728	75,410
Bluefish, fresh	610.256	18,376	Shoemaker, fresh	12,300	513
Bream and sunfish, fresh	451.108	22.743	Silver perch, fresh	181,182	7,075
Buffalo-fish, fresh	1,315.750	24,847	Snappers, red, fresh	4,480,617	133,749
Catfish, fresh	2,850.007	59,550	Snappers, gray and others, fresh	47,303	967
Channel bass, fresh	2,160,767	77,410	Spanish mackerel, fresh	693,659	42,500
Crevalle, fresh	84.374	2,879	Spanish mackerel, salted	6,800	192
Croakers, fresh	532.540	21,555	Spots, fresh	137,250	4,009
Drum, fresh-water, fresh	71,084	2.123	Striped bass, fresh	58,950	3,441
Drum, salt-water, fresh	136.053	2,286	Trout, fresh	2.908,083	121,228
Flounders, fresh	276.245	12.853	Trout, salted	51,350	1,342
Groupers, fresh	427,781	4,893	Whiting, fresh	29.549	586
Grunts, fresh	680,725	22,202	Miscellaneous fish, fresh	822.591	38,452
Jewfish, fresh	46.000	1,874	Miscellaneous fish, salted	67,900	1,457
Jurel, fresh	346,125	4.139	Sponges	366.772	438.682
Kingfish, fresh	291,725	12.625	Oysters	*20,587,098	796,062
Lady-fish, fresh	112.504	1,685	Quahogs	†7.330	747
Lady-fish, salted	22.000	660	Shrimp	7,451.350	108,811
Mullet, fresh	11,915.114	140,939	Crayfish	140.650	7,030
Mullet, salted	2.968,254	80.184	Crabs, hard	1,074.160	19,217
Mullet, smoked	3,200	148	Crabs, soft	144,500	7,277
Mullet roe, salted	298.549	17,257	Terrapins	73,413	4,145
Pickerel and pike, fresh	81,700	3.027	Turtles	1.142,049	32,652
Pinfish, fresh	123,151	2,746	Turtle eggs	6,625	994
Pompano, fresh	325.559	33,681	Tortoise shell	1,153	2,884
Pompano, salted	41,300	1,870			
Rock bass, fresh	54,200	3,047	Total	69.075,534	2.438,675

* 2,941,014 bushels.

† 733 bushels.

In the following table the relative quantity and value, in 1890, of each product is shown for each State and for the entire region. The figures represent the percentage which each species bears to the aggregate yield of the fisheries of the States and region.

7.—Table showing by States the percentage of the quantity and value of each species taken in the fisheries of the Gulf States in 1890.

Species.	Florida.		Alabama.		Mississippi.		Louisiana.		Texas.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber-fish	.24	.24									09	.11
Angel-fish	.46	.19	.11	.03	.36	.41					23	.13
Black bass	.02	.01			.07	.12	.39	.64			13	.19
Bluefish	1.53	1.03	1.17	.78	1.18	1.87	.06	.13	.32	.42	.88	.75
Bream and sunfish	.14	.09	.40	.62	1.10	1.47	1.30	2.38	.43	.49	.65	.93
Buffalo-fish					1.50	.50	5.68	3.48	.17	.22	1.91	1.02
Catfish			.79	.61	1.15	.73	12.86	8.29	.57	.66	4.13	2.44
Channel bass	1.67	.68	1.14	1.45	2.48	3.56	1.63	1.71	13.92	15.26	3.13	3.17
Crevalle	.07	.02	.21	.23					.71	.72	.12	.12
Croakers	.16	.06	2.05	2.09	.70	.60	.76	1.44	2.22	2.14	.77	.89
Drum, fresh-water	.19	.07					.09	.21			.10	.09
Drum, salt-water	.44	.17	.15	.14	.04	.07			.05	.03	.20	.09
Flounders	.09	.03	.41	.77	.94	1.26	.12	.36	1.64	1.86	.40	.53
Groupers	1.45	.42	.24	.15			.08	.03			.62	.20
Grunts	2.48	2.08									.99	.91
Jewfish									.58	.60	.07	.08
Jurel	1.15	.34	.65	.30							.50	.17
Kingfish	1.06	1.18									.42	.52
Lady-fish	.44	.21	.27	.08							.20	.10
Mullet	50.77	19.84	12.30	8.46	3.76	1.42	1.38	1.22	1.05	.88	21.98	9.78
Pickerel and pike			.72	.67	.18	.24			.41	.45	.12	.12
Pinfish	.19	.07	.32	.24	.68	.65					.18	.11
Pompano	1.10	2.48	.36	1.66	.18	.67	.16	.66	.03	.19	.53	1.46
Rock bass							.27	.46			.08	.12
Sailor's choice	.21	.08	.06	.06					.32	.38	.13	.09
Sea bass	.02	.01			.29	.43					.04	.05
Sheepshead	1.98	.89	.74	.85	2.13	3.20	1.88	3.92	9.78	9.84	2.78	3.09
Shoemaker									.15	.16	.02	.02
Silver perch	.13	.07	.10	.05			.67	.94			.26	.29
Snappers, red	15.22	11.63	1.31	1.61			1.16	1.09	.06	.08	6.49	5.48
Snappers, gray and others	.17	.09									.07	.04
Spanish mackerel	1.61	1.99	.92	1.59	.57	1.28	.69	2.22	.31	.42	1.01	1.75
Spots	.13	.05	.53	.39	.56	.56	.15	.23			.20	.16
Striped bass							.24	.46	.11	.12	.09	.14
Trout	2.20	1.26	4.37	6.91	4.58	7.16	3.15	5.00	14.08	15.25	4.29	5.03
Whiting	.09	.05	.09	.04							.04	.02
Miscellaneous fish	1.99	2.24					.78	1.41	2.31	2.15	1.29	1.64
Sponges	1.34	41.22									.53	17.99
Oysters	9.47	8.80	70.49	69.61	69.43	67.83	28.34	45.43	38.77	40.78	29.80	32.64
Quahogs	.03	.07									.01	.03
Shrimp					7.54	5.14	32.05	13.71	2.21	1.81	10.79	4.46
Crayfish							.68	1.07			.20	.29
Crabs, hard					.40	.53	4.09	1.94	2.40	1.62	1.55	.79
Crabs, soft					.18	.30	.62	.99			.21	.30
Terrapins	.02	.01	.10	.61			.28	.23	.08	.49	.11	.17
Turtles	1.74	2.33					.44	.35.	7.32	2.98	1.66	1.50
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

The above table shows that in Florida the mullet constitutes 50.77 per cent of the output and 19.84 per cent of the value of the fisheries. The red snapper is the next important species as regards quantity, forming 15.22 per cent of the yield, but the relative value—viz, 11.63 per cent—is less than that of sponges. The proportion of oysters to the total yield is 9.47 per cent of the quantity and 8.80 per cent of the value. The quantity of sponges taken is only 1.34 per cent, but the value is 41.22 per cent, and is greater than that of any other product. The disparity between the quantity and value of the yield is worthy of notice.

In Mississippi and Alabama the oyster surpasses, both in quantity and value, all the other products combined, and represents about 70 per cent of the total catch and income of the fishermen. The only other products of importance are mullet in Mississippi, and trout and shrimp in Alabama.

Oysters constitute 28.34 per cent of the quantity and 45.43 per cent of the value of the product of the Louisiana fisheries, and shrimp 32.05 per cent and 13.71 per cent, respectively. Catfish is the only additional product that is relatively important, with 12.86 per cent of the quantity and 8.29 per cent of the value.

In Texas the output of oysters is 38.77 per cent of the quantity and 40.78 per cent of the value of the catch. Three fish are also important—viz, channel bass, trout, and sheepshead—the proportions for each being from 10 to 15 per cent of quantity and value. Turtles constitute 7.32 per cent of the yield, but have a much lower relative value.

Taking the region as a whole, the products which are taken in largest quantities are, in the order of their rank, oysters, mullet, shrimp, red snappers, and trout. With the value of the catch as a basis, the important species are oysters, sponge, mullet, red snappers, and trout.

Comparisons with 1880.—Table 8 shows in a condensed form the changes which have taken place in the fisheries of the Gulf States between 1880 and 1890.

There has been a large increase in the number of persons engaged in the fisheries, which has been participated in by every State except Alabama. The increase has been 6,621, or 129.04 per cent. Louisiana has undergone the greatest actual advance, and Mississippi the largest relative increase.

Every State has shared in the increase in the amount of capital invested in the fishing industry. This was $2,432,708, or 445.89 per cent, Florida leading the other States in the actual money value of the advance and Mississippi in the percentage.

The value of the products of the fisheries in 1890 was $1,211,131, or 98.66 per cent more than in 1880. As in the case of the investment, Florida and Mississippi respectively show the greatest real and proportional increase.

8.—Comparative table showing the extent of the fisheries of the Gulf States in 1880 and 1890.

States.	Persons employed.				Capital invested.			
	1880.	1890.	Increase or decrease in 1890.	Percentage of increase or decrease in 1890.	1880.	1890.	Increase in 1890.	Percentage of increase in 1890.
Florida	2,112	4,068	+1,956	+ 92.61	$362,563	$1,369,294	+$1,006,731	+ 277.67
Alabama	635	618	− 17	− 2.68	38,200	135,290	+ 97,090	+ 254.16
Mississippi	186	1,721	+1,535	+825.27	8,800	434,710	+ 425,910	+4,839.89
Louisiana	1,597	4,068	+2,471	+154.73	93,621	719,876	+ 626,255	+ 668.93
Texas	601	1,277	+ 676	+112.48	42,400	319,122	+ 276,722	+ 652.65
Total	5,131	11,752	+6,621	+129.04	545,584	2,978,292	+ 2,432,708	+ 445.89

States.	Value of products.			
	1880.	1890.	Increase in 1890.	Percentage of increase in 1890.
Florida	$564,819	$1,064,139	+ $499,320	+ 88.40
Alabama	119,275	154,871	+ 35,596	+ 29.84
Mississippi	22,540	245,699	+ 223,159	+990.06
Louisiana	392,610	660,134	+ 267,524	+ 68.14
Texas	128,300	313,832	+ 185,532	+144.61
Total	1,227,544	2,438,675	+1,211,131	+ 98.66

More than a third of the aggregate increase in the value of products during the decade specified accrued from oysters. In all the States the augmentation of the output of this product since 1880 has been phenomenally large. The following table gives by States the quantity and value of oysters taken in this region in 1880 and 1890:

9.—Comparative table showing by States the oyster yield of the Gulf States in 1880 and 1890.

States.	1880.		1890.	
	Bushels.	Value.	Bushels.	Value.
Florida	58, 600	$10, 950	371, 081	$93, 692
Alabama	104, 500	44, 950	481, 070	107, 812
Mississippi	25, 000	10, 000	806, 478	166, 672
Louisiana	295, 000	*118, 000	841, 585	299, 896
Texas	95, 625	47, 300	440, 800	127, 990
Total	578, 725	231, 200	2, 941, 014	796, 062

* The value assigned in "The Fisheries and Fishery Industries of the United States," Section II, is $200,000, or nearly 70 cents a bushel. This is a manifest error, and conflicts with other statements in the same report. The price given in this table is thought to be approximately correct.

II.—FISHERIES OF FLORIDA.

Note on the geography of the coast.—The west side of Florida has a larger coast line than any other Gulf State, the approximate length being 2,810 miles. The shores are very low and are indented with numerous bays, sounds, and lagoons. These are generally shut in from the open waters of the Gulf by keys and low sand-spits, which are important factors to the fishing interests, as nearly all the shore fishing is carried on in the shallow water between them and the mainland. The water in most of the bays and sounds is very clear. Many of the indentations are remarkable for extensive mud and grassy flats and "coon-oyster" bars, which restrict navigation or render it difficult. The principal indentations are Charlotte Harbor, Tampa Bay, Wiccassassee Bay, Apalachee Bay, St. George Sound, Apalachicola Bay, St. Andrew Bay, Choctawhatchee Bay, Santa Rosa Sound, and Pensacola Bay, the second and last affording excellent anchorage and harbor facilities to large vessels. The rivers and small streams entering the Gulf are numerous, and some are navigable for considerable distances. The most important are the Caloosahatchee, Manatee, Withlacoochee, Suwannee, Apalachicola, Choctawhatchee, and Escambia.

There are numerous cities, towns, villages, and "camps" located at frequent intervals along the coast that are more or less interested in or dependent upon the fisheries, among which may be mentioned Key West, Punta Gorda, St. Petersburg, Tampa, Cedar Keys, Apalachicola, St. Andrew Bay, and Pensacola.

Importance of the fisheries.—In most respects, the fisheries of western Florida are more important and extensive than those of any other State of this region. The number of persons engaged in the industry is the same as in Louisiana, but in the value of the fishing property and in the quantity and value of the catch Florida is far in advance of other States. Since 1880 there has been a noteworthy advance in the fisheries, as shown in the previous section of this report. Florida is now the only State from which the sponge fishery is prosecuted, and the increase in this important branch during the decade has been large. There are other products in the yield of which the State takes precedence, as bluefish, mullet, red snappers, Spanish mackerel, and turtles, although in the output of oysters it ranks last.

Condensed statistics.—Tables 10, 11, 12, and 13 give a summary of the economic fisheries of the west coast of Florida as they existed in 1889 and 1890.

From Table 10 it will be seen that in the latter year 2,517 persons engaged in the shore or boat fisheries, 1,030 in the vessel fisheries, 55 in the transporting trade, and 466 in the shore industries connected with the fishing business. The relatively large number of vessel fishermen is a prominent feature.

In Table 11 the nationalities of the persons employed are given in some detail. While the native or naturalized citizens of the United States greatly predominate, and constitute seven-tenths of the fishing population, there is a large number of fishermen from the British possessions in the West Indies, principally the Bahamas; these are the most numerous foreign element in the fisheries of the State; about four-fifths are colored. The other important nationalities represented are Spanish, Portuguese, Italian, Norwegian, and Greek.

Considering the number and value of vessels, boats, apparatus, etc., employed in the fisheries of Florida, the following figures are presented in Table 12: The number of vessels engaged in 1890 was 166, a much larger fleet than any other State in this region possesses; these were valued at $386,318, including their outfits, and the apparatus carried was worth $5,460 more. The 2,075 boats employed in the shore fisheries had a value of $263,529 with their outfits. The apparatus of capture in the shore or boat fisheries was worth $44,180, seines and gill nets being the most expensive forms. The shore property and cash capital required for carrying on the fisheries and the shore industries dependent thereon amounted to $669,807. The total investment was $1,369,294, a sum considerably in excess of that of any other Gulf State.

The total yield of the commercial fisheries in 1889 was 23,597,240 pounds, worth $948,845; in 1890 it was 27,418,562 pounds, valued at $1,064,139, this substantial increase being chiefly in mullet, oysters, and sponges. The two most important products of the Florida fisheries in 1890 were sponges, valued at $438,682, and mullet, worth $211,161. After these come red snappers, oysters, turtles, pompano, grunts, and Spanish mackerel.

10.—Table of persons employed.

How engaged.	1889.	1890.
On vessels fishing	952	1,030
On vessels transporting	44	55
In shore fisheries	*2,338	*2,517
On shore, in factories, etc	405	466
Total	3,739	4,068

*In addition to these persons, there were 278 alligator-hunters in 1889 and 267 in 1890 employed in the coast counties of western Florida.

11.—Table showing the nationality of persons engaged.

Nationalities.	In vessel fisheries.		In shore fisheries.		On shore.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Americans, white	311	335	1,293	1,420	239	271	1,843	2,026
Americans, colored	47	48	534	570	157	181	738	799
British provincials, white	14	13	123	121	2	2	139	136
British provincials, colored	530	592	164	162			694	754
Italians			47	53	6	8	53	61
Portuguese	23	29	27	28			50	57
Spaniards	22	19	57	56		1	79	76
Norwegians	30	23	8	9			38	32
Swedes			6	7			6	7
Greeks			17	29			17	29
French	5	3					5	3
Chinese					1	3	1	3
Others	14	23	62	62			76	85
Total	996	1,085	2,338	2,517	405	466	3,739	4,068

12.—Table of apparatus and capital.

Designation.	1889.		1890.	
	Number.	Value.	Number.	Value.
Vessels fishing	132	$201,200	145	$213,990
Tonnage	2,196.61		2,356.67	
Outfit		125,919		139,813
Vessels transporting	18	23,750	21	27,750
Tonnage	240.56		280.21	
Outfit		4,145		4,765
Boats	1,954	137,890	2,075	147,538
Outfit		105,942		115,991
Apparatus of capture—vessel fisheries:				
Seines	8	735	9	850
Gill nets	17	465	26	690
Turtle nets	18	900	17	800
Lines		1,511		1,584
Tongs	20	161	27	217
Dredges	1	30	6	180
Sponge outfit		1,049		1,139
Apparatus of capture—shore fisheries:				
Seines and stop nets	156	11,955	196	14,540
Gill nets	654	17,530	714	18,998
Turtle nets	114	3,186	136	3,746
Cast nets	107	670	109	683
Lines		1,791		2,068
Tongs and rakes	295	2,401	323	2,622
Sponge outfit		1,373		1,388
Miscellaneous		135		135
Shore property		168,002		183,207
Cash capital		470,450		486,600
Total		1,281,190		1,369,294

NOTE.—In addition to the above fishing property, the alligator hunters of the west coast of Florida had, in 1889, 76 boats, valued at $1,250; outfits and provisions, valued at $3,540, and 294 guns, valued at $4,410; and in 1890 the same number of boats, with $3,518 worth of outfits, etc., and 283 guns, valued at $4,245.

13.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Amber-fish, fresh	60, 000	$2, 400	65, 000	$2, 600
Angel-fish, fresh	89, 690	1, 423	126, 726	2, 005
Black bass, fresh	4, 300	86	5, 000	100
Bluefish, fresh	364, 397	9, 315	420, 046	10, 398
Bream and sunfish, fresh	25, 859	719	38, 088	966
Channel bass, fresh	390, 997	6, 005	457, 737	7, 236
Channel bass, salted	1, 000	25	....	....
Crevalle, fresh	17, 280	246	18, 024	287
Croakers, fresh	36, 368	565	42, 923	650
Drum, fresh-water, fresh	48, 974	684	52, 884	771
Drum, salt-water, fresh	102, 305	1, 478	121, 853	1, 836
Flounders, fresh	20, 129	276	23, 620	336
Groupers, fresh	417, 522	6, 462	398, 731	4, 490
Grunts, fresh	611, 855	20, 016	680, 725	22, 202
Jurel, fresh	167, 616	2, 149	314, 840	3, 666
Kingfish, fresh	456, 231	16, 747	291, 725	12, 625
Lady-fish, fresh	103, 426	1, 502	99, 584	1, 556
Lady-fish, salted	22, 800	684	22, 000	660
Mullet, fresh	8, 794, 586	97, 699	10, 650, 959	113, 572
Mullet, salted	2, 728, 785	83, 306	2, 968, 254	80, 184
Mullet, smoked	4, 500	215	3, 200	148
Mullet roe, salted	244, 080	15, 218	298, 549	17, 257
Pinfish, fresh	33, 309	475	52, 535	778
Pompano, fresh	267, 693	26, 596	259, 056	24, 489
Pompano, salted	76, 062	3, 048	41, 300	1, 870
Sailor's choice, fresh	58, 205	844	58, 277	856
Sea bass, fresh	5, 200	124	5, 700	136
Sheepshead, fresh	527, 126	9, 465	543, 797	9, 449
Silver perch, fresh	20, 908	424	36, 177	796
Snappers, red, fresh	3, 469, 370	105, 557	4, 172, 942	123, 799
Snappers, gray and others, fresh	45, 867	927	47, 303	967
Spanish mackerel, fresh	344, 814	17, 405	434, 193	20, 908
Spanish mackerel, salted	18, 600	506	6, 800	192
Spots, fresh	25, 145	349	35, 315	508
Trout, fresh	517, 241	11, 409	551, 113	12, 036
Trout, salted	97, 440	2, 413	51, 350	1, 342
Whiting, fresh	14, 934	361	25, 242	521
Miscellaneous fish, fresh	436, 260	20, 404	477, 211	22, 389
Miscellaneous fish, salted	93, 500	2, 054	67, 900	1, 457
Sponges	316, 559	381, 087	366, 772	438, 682
Oysters	*2, 064, 097	75, 189	†2, 597, 567	93, 692
Quahogs	‡7, 330	747	‡7, 330	747
Terrapins	5, 000	125	4, 180	130
Turtles	432, 877	18, 706	468, 256	20, 972
Turtle eggs	6, 000	900	6, 625	994
Tortoise shell	1, 003	2, 510	1, 153	2, 884
Total	23, 597, 240	948, 845	27, 418, 562	1, 064, 139

* Equivalent to 294,871 bushels. † Equivalent to 371,081 bushels. ‡ Equivalent to 733 bushels.

NOTE.—In order to show the extent of the fisheries of the entire State, the following condensed table, covering the east coast of the State, is introduced. Combining the two sets of figures, it is seen that the fisheries of the east and west coasts gave employment to 4,983 persons in 1889 and 5,472 persons in 1890. The capital invested was $1,411,344 in the former year and $1,510,673 in the latter, and the value of the products of the fisheries was $1,148,933 in 1889 and $1,281,670 in 1890, not including alligators.

Designation.	1889.	1890.
Persons employed:		
Vessel fishermen....No..	2	6
Shore fishermen.....do..	1, 059	1, 168
Shoresmen ....do..	183	230
Total	1, 244	1, 404
Apparatus and capital:		
Vessels ....No..	1	3
Boats ....do..	656	715
Seines ....do..	86	105
Gill nets ....do..	357	468
Total value of fishing property	$130, 154	$141, 379

Designation.	1889.	1890.
Products:		
Pounds of fish	5, 344, 418	6, 547, 648
Value	$181, 154	$193, 808
Pounds of mollusks	441, 292	687, 050
Value	$11, 423	$15, 200
Pounds of reptiles	48, 802	70, 450
Value	$4, 291	$5, 866
Pounds of crustaceans	89, 000	67, 900
Value	$3, 220	$2, 657
Total pounds	5, 923, 512	7, 373, 048
Value	$200, 088	$217, 531

In addition to the products shown in the foregoing table the following were taken by the fishermen of Key West and mostly used for bait: In 1889, 135,000 spiny lobsters (*Panulirus americanus*), locally called "crawfish," valued at $4,500; 12,500 meats of the conch (*Strombus gigas*), valued at $625; and 73,000 pounds of "sardines" and "pilchards" (*Clupea pensacolæ* and *C. sardina*), valued at $1,168; in 1890, 166,000 spiny lobsters, valued at $5,533; 13,000 conch meats, valued at $650; and 79,000 pounds of "sardines" and "pilchards," valued at $1,264.

The alligator industry of the west coast of Florida, which is not covered in the regular statistics, resulted as follows: In 1889, 43,455 alligator hides, valued at $32,963; 70,286 alligator feet, valued at $3,506, and 825 otter skins, valued at $1,912; in 1890, 48,942 alligator hides, valued at $35,465; 84,110 alligator feet, valued at $4,205, and 775 otter skins, valued at $1,787. The hunting of alligators is prosecuted in Lee, De Soto, Manatee, Hillsboro, Levy, Wakulla, and Franklin counties, but is most important in Lee County, where about eleven-twelfths of the product is taken. The otter (*Lutra canadensis*) is incidentally hunted with the alligators in Lee and De Soto counties.

The fisheries by counties.—There are 19 coastal counties on the Gulf side of Florida; in 18 of these there are commercial fisheries. The two counties having the most extensive fishing interests are Monroe and Escambia, which occupy the two extremes of the coast line and contain the important fishing towns of Key West and Pensacola.

Detailed figures for each county are given in the three following tables, relating to persons employed, capital invested, and products. Many additional phases of the fisheries in each county are also contained in the tables showing the vessel and shore fisheries and the fisheries by apparatus.

14.—Table showing by counties the number of persons employed in the fisheries of the west coast of Florida in 1889 and 1890.

Counties.	On vessels fishing.		On vessels transporting.		In shore fisheries.		On shore, in factories, etc.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Monroe	660	717	10	16	714	724	96	101	1,480	1,558
Lee					85	106	10	10	95	116
De Soto			6	8	89	105	22	24	117	137
Manatee	3	3	8	8	115	128	12	12	138	151
Hillsboro	7	2	14	14	165	208	84	107	270	331
Pasco					16	24			16	24
Hernando					41	42			41	42
Citrus					35	40	9	9	44	49
Levy	13	24	2	6	170	161	25	24	210	215
Lafayette					40	40			40	40
Taylor					112	112	2	2	114	114
Jefferson					4	10			4	10
Wakulla		5			206	224	1	1	207	230
Franklin	62	49	4	3	193	233	106	137	365	422
Calhoun					24	24			24	24
Washington	25	28			121	123			146	151
Santa Rosa	4	4			6	6			10	10
Escambia	178	198			202	207	38	39	418	444
Total	952	1,030	44	55	2,338	2,517	405	466	3,739	4,068

15.—Table showing by counties the apparatus and capital employed in the fisheries of the west coast of Florida in 1889 and 1890.

Designation.	Monroe.				Lee.				De Soto.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	81	$124,900	89	$128,470								
Tonnage	1,159.83		1,187.08									
Outfit		73,378		78,696								
Vessels transporting	2	5,800	3	8,300					3	$2,000	4	$3,000
Tonnage	72.98		104.83						22.01		29.73	
Outfit		550		870						520		700
Boats	835	67,625	840	66,875	18	$2,310	24	$2,965	78	4,425	94	5,660
Outfit		53,368		55,916		4,075		4,795		8,360		8,675
Apparatus of capture—vessel fisheries:												
Seines			1	100								
Gillnets	6	150	6	150								
Turtle nets	18	900	17	800								
Lines		50										
Sponge outfits		972		1,080								
Apparatus of capture—shore fisheries:												
Seines and stop nets	2	90	2	90	6	950	9	1,250			1	125
Gill nets					1	25	2	50	79	2,215	86	2,420
Turtle nets	15	750	15	750	6	150	6	150			2	60
Cast nets	15	105	15	105			2	13				
Lines		1,680		1,913						20		20
Tongs and rakes					6	29	7	37	10	80	17	136
Sponge outfits		1,325		1,325								
Miscellaneous		135		135								
Shore property and accessories		55,665		60,740		1,700		1,740		1,705		1,825
Cash capital		285,500		297,500		10,000		10,000		16,000		15,750
Total		672,943		703,815		19,239		21,000		35,325		38,371

Designation.	Manatee.				Hillsboro.				Pasco.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	1	$500	1	$500	4	$4,400	1	$400				
Tonnage	10.40		10.40		43.43		7.00					
Outfit		260		260		450		125				
Vessels transporting	4	3,450	4	3,450	5	8,600	5	8,600				
Tonnage	35.07		35.07		53.75		53.75					
Outfit		480		480		2,160		2,250				
Boats	100	5,635	111	6,955	222	16,560	269	19,415	14	$155	16	$225
Outfit		5,664		6,350		9,875		13,335		255		545
Apparatus of capture—vessel fisheries:												
Gill nets	7	205	7	205								
Tongs					2	17	2	17				
Dredges					1	30						
Apparatus of capture—shore fisheries:												
Seines and stop nets	40	2,205	42	2,265	37	1,980	60	3,440				
Gill nets	109	2,995	120	3,270	123	3,340	170	4,525	12	300	16	365
Cast nets					62	400	62	400				
Lines						13		23				
Tongs and rakes	2	18	2	18	39	332	39	332				
Shore property and accessories		1,025		1,000		25,629		33,334		85		135
Cash capital						21,600		24,700				
Total		22,437		24,753		95,386		110,896		795		1,270

15.—Table showing by counties the apparatus and capital employed in the fisheries of the west coast of Florida in 1889 and 1890—Continued.

Designation.	Hernando.				Citrus.				Levy.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing									1	$2,250	[illegible]	$4,950
Tonnage									18.50		37.17	
Outfit										774		1,715
Vessels transporting									1	500	3	2,100
Tonnage									5.19		19.50	
Outfit										125		325
Boats	31	$310	30	$300	33	$935	27	$875	147	14,701	143	15,895
Outfit		500		550		885		1,145		8,410		8,165
Apparatus of capture—vessel fisheries:												
Sponge outfits										18		33
Apparatus of capture—shore fisheries:												
Seines and stop nets									3	300	10	760
Gill nets	31	930	30	900	25	640	16	480	76	2,280	59	1,770
Turtle nets									93	2,286	113	2,786
Lines						1		1				10
Tongs and rakes					10	75	17	128	41	322	34	266
Sponge outfits										7		7
Shore property and accessories		50		50		550		550		3,990		3,715
Cash capital						850		850		13,000		10,000
Total		1,790		1,800		3,936		4,029		48,963		52,497

Designation.	Lafayette.				Taylor.				Jefferson.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	20	$160	20	$160	56	$468	56	$464	2	$16	5	$40
Outfit		500		500		1,025		1,035		50		125
Apparatus of capture—shore fisheries:												
Gill nets	20	500	20	500	56	1,262	56	1,256	2	50	5	125
Shore property and accessories		75		75		235		235		10		20
Total		1,235		1,235		2,990		2,990		126		310

Designation.	Wakulla.				Franklin.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing			1	$100	12	$6,150	12	$5,750				
Tonnage			5.49		93.26		86.70					
Outfit				125		2,090		1,815				
Vessels transporting					2	1,409	1	800				
Tonnage					31.15		16.93					
Outfit						190		90				
Boats	115	$1,760	121	1,843	146	12,621	177	15,501	9	$240	9	$240
Outfit		4,070		4,445		3,430		4,970		625		600
Apparatus of capture—vessel fisheries:												
Seines					2	130						
Gill nets					4	110	13	335				
Lines								4				
Tongs					18	144	25	200				
Sponge outfits				4		50		22				
Apparatus of capture—shore fisheries.												
Seines and stop nets	9	810	10	885	8	750	10	940	4	500	4	500
Gill nets	91	2,113	95	2,207	24	710	31	855				
Cast nets					15	90	15	90	6	30	6	30
Lines		1		1		10		10				
Tongs and rakes	8	65	8	65	107	854	127	1,014				
Sponge outfits		8		8		33		48				
Shore property and accessories		5,853		5,908		14,545		16,896		75		75
Cash capital		4,000		4,000		23,500		28,500				
Total		18,680		19,591		66,816		77,839		1,470		1,445

15.—Table showing by counties the apparatus and capital employed in the fisheries of the west coast of Florida in 1889 and 1890—Continued.

Designation.	Washington.				Santa Rosa.				Escambia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	5	$4,950	7	$7,650	1	$500	1	$570	29	$57,550	31	$65,600
Tonnage	77.36		106.37		5.36		5.36		788.47		911.19	
Outfit		1,395		1,830		295		255		47,277		54,992
Vessels transporting	1	2,000									1	1,500
Tonnage	20.41										20.41	
Outfit		120										50
Boats	68	3,030	71	3,095	5	330	5	380	55	6,600	57	6,650
Outfit		4,450		4,450		400		400				
Apparatus of capture—vessel fisheries:												
Seines	2	255	3	350	1	100	1	100	3	250	4	300
Lines		56		78		40		50		1,365		1,452
Dredges											6	180
Apparatus of capture—shore fisheries:												
Seines and stop nets	22	2,375	22	2,345	1	100	1	100	24	1,895	25	1,840
Gill nets	4	120	6	150					1	50	2	125
Cast nets	9	45	9	45								
Lines						20				46		90
Tongs and rakes	28	230	28	230					44	396	44	396
Shore property and accessories		3,100		3,135		275		275		53,435		53,500
Cash capital										96,000		95,300
Total		22,126		23,358		2,060		2,130		264,864		281,975

Designation.	Total for west coast.			
	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	132	$201,200	145	$213,990
Tonnage	2,196.61		2,356.67	
Outfit		125,919		139,813
Vessels transporting	18	23,750	21	27,750
Tonnage	240.56		280.21	
Outfit		4,145		4,765
Boats	1,954	137,890	2,075	147,538
Outfit		105,942		115,991
Apparatus of capture—vessel fisheries:				
Seines	8	735	9	850
Gill nets	17	465	26	690
Turtle nets	18	900	17	800
Lines		1,511		1,584
Tongs	20	161	27	217
Dredges	1	30	6	180
Sponge ontfits		1,049		1,139
Apparatus of capture—shore fisheries:				
Seines and stop nets	156	11,955	196	14,540
Gill nets	654	17,530	714	18,998
Turtle nets	114	3,186	136	3,746
Cast nets	107	670	109	683
Lines		1,791		2,068
Tongs and rakes	295	2,401	323	2,622
Sponge outfits		1,373		1,388
Miscellaneous		135		135
Shore property and accessories		168,002		183,207
Cash capital		470,450		486,600
Total		1,281,190		1,369,294

16.—Table showing by counties and species the yield of the fisheries of the west coast of Florida in 1889 and 1890.

Species.	Monroe.				Lee.				De Soto.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber-fish, fresh	60,000	$2,400	65,000	$2,600								
Angel-fish, fresh									4,290	$59	6,000	$75
Channel bass, fresh									65,585	857	71,820	898
Drum, fresh-water, fresh									4,577	61	5,300	70
Drum, salt-water, fresh									6,114	77	7,285	91
Groupers, fresh	50,700	2,490										
Grunts, fresh	587,630	19,588	650,950	21,707								
Kingfish, fresh	456,231	16,747	291,725	12,625								
Lady-fish, fresh	4,060	515	5,000	550								
Mullet, fresh	61,500	786	68,450	919	2,332	$350	2,963	$400	1,372,560	14,475	1,436,135	16,975
Mullet, salted			15,000	600	767,900	31,676	604,346	21,558	96,000	1,450	134,000	2,050
Mullet, smoked					3,000	150	2,000	100				
Mullet roe, salted			2,200	154	60,974	3,915	60,843	3,486	34,300	775	15,515	624
Pinfish, fresh									4,000	50	4,500	56
Pompano, fresh									54,226	3,257	56,963	3,411
Pompano, salted					2,350	353	3,500	525				
Sailor's choice, fresh									5,400	68	5,825	73
Sheepshead, fresh	1,000	15	1,200	18					119,979	1,500	125,775	1,572
Snappers, red, fresh	100,000	5,000	20,000	1,000								
Snappers, gray and others, fresh	1,000	125	1,000	125					3,328	67	4,300	55
Spanish mack'l, fresh	20,000	2,000	22,500	2,250					17,004	1,026	17,855	1,077
Trout, fresh	900	14	1,000	15					51,385	642	53,750	672
Other fish, fresh	378,000	18,900	416,850	20,843								
Sponges	307,585	367,954	358,467	427,325								
Oysters					19,300	800	13,835	1,065	37,100	2,130	78,286	4,515
Quahogs	1,330	200	1,330	200	1,330	62	1,330	62				
Turtles	287,092	12,236	291,804	12,352	3,500	350	3,000	280			4,000	320
Turtle eggs	3,600	540	4,200	630								
Tortoise shell	1,003	2,510	1,153	2,884								
Total	2,322,261	452,020	2,217,779	506,847	791,746	37,625	691,570	27,479	1,823,313	22,644	2,020,740	27,534

Species.	Manatee.				Hillsboro.				Pasco.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh	27,751	$529	30,532	$603	21,786	$319	28,929	$462				
Bluefish, fresh	22,471	416	29,501	581	22,585	423	34,154	653				
Channel bass, fresh	62,323	1,022	77,516	1,281	76,162	1,040	105,704	1,531				
Crevalle, fresh	6,259	80	6,043	93	5,921	89	7,077	121				
Drum, fresh-water, fresh	24,490	346	23,007	338	19,586	277	34,287	363				
Drum, salt-water, fresh	19,842	274	26,703	405	15,688	217	28,478	464				
Flounders, fresh	10,677	143	11,378	150	8,542	114	11,442	160				
Groupers, fresh					30,000	600	35,000	700				
Grunts, fresh	7,782	118	9,859	140	16,433	310	19,916	353				
Jurel, fresh	10,904	174	11,516	191	11,016	205	14,061	263				
Mullet, fresh	1,406,724	9,948	2,158,036	16,094	1,425,062	10,537	2,408,815	15,966	25,200	$297	121,700	$1,100
Mullet, salted	306,825	7,055	276,972	6,116	133,873	2,620	136,907	3,044	50,350	905	57,450	1,121
Mullet, smoked					1,500	65	1,200	45				
Mullet roe, salted	33,650	1,885	27,400	1,320	5,900	300	10,955	524				
Pompano, fresh	35,235	1,720	38,503	1,965	90,062	4,073	87,112	4,006				
Pompano, salted	15,112	747	8,300	415								
Sailor's choice, fresh	15,621	225	14,641	218	14,304	200	15,919	237				
Sea bass, fresh					2,000	60	2,200	66				
Sheepshead, fresh	73,610	1,370	79,262	1,522	90,477	1,165	102,998	1,494				
Snappers, gray and others, fresh	16,739	310	17,539	340	13,810	203	17,104	257				
Spanish mack'l, fresh	34,991	1,713	28,950	1,701	32,007	2,312	72,090	4,557				
Spanish mackerel, salted					1,000	50						
Trout, fresh	64,875	1,884	71,085	2,001	60,565	1,245	91,115	1,720				
Other fish, fresh					13,125	262	17,062	340				
Other fish, salted					8,000	100	4,000	50				
Oysters	525	25	630	30	416,920	13,734	414,340	13,743				
Quahogs					1,340	83	1,340	83				
Turtles	60,000	1,400	60,000	1,400	10,000	150	10,944	170				
Turtle eggs	665	100	665	100	1,738	200	1,700	204				
Total	2,247,000	31,484	2,968,738	37,113	2,527,083	43,063	3,738,734	38,994	75,550	1,202	179,150	2,221

16.—*Table showing by counties and species the yield of the fisheries of the west coast of Florida in 1889 and 1890*—Continued.

Species.	Hernando.				Citrus.				Levy.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh									20,749	$312	19,800	$297
Bluefish, fresh									30,338	455	29,196	438
Channel bass, fresh	1,000	$15	1,800	$27	2,000	$50	2,300	$58	106,165	1,592	102,137	1,533
Crevalle, fresh									5,100	77	4,904	73
Drum, salt-water, fresh									60,665	910	58,392	876
Groupers, fresh											10,000	250
Jurel, fresh									12,066	181	11,688	176
Mullet, fresh	172,500	1,494	157,100	1,390	94,296	1,070	60,348	718	909,981	9,100	875,886	8,759
Mullet, salted	28,900	722	30,500	762	52,000	1,159	57,850	1,298	51,735	1,170	45,952	1,035
Mullet roe, salted									5,556	278	4,346	217
Pompano, fresh					1,250	50	550	22	9,000	450	1,500	75
Sailor's choice, fresh									22,750	342	21,892	328
Sheepshead, fresh	1,500	23	2,000	30	29,520	1,024	24,000	630	121,330	1,820	116,785	1,752
Snappers, red, fresh											6,000	150
Snappers, gray and others, fresh					9,000	220	7,300	190				
Spanish mack'l, fresh									750	36	500	25
Trout, fresh	5,000	75	7,500	112	16,300	342	10,540	231	227,496	4,550	218,972	4,380
Sponges									952	965	4,160	5,000
Oysters					27,125	969	34,440	1,230	145,425	5,194	116,200	3,602
Quahogs									3,330	400	3,330	400
Terrapins									5,000	125	4,180	130
Turtles									70,705	4,596	89,958	6,297
Total	208,900	2,329	198,900	2,321	231,491	4,884	197,328	4,377	1,809,093	32,553	1,745,778	35,793

Species.	Lafayette.				Taylor.				Jefferson.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pouuds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Mullet, fresh	261,250	$4,750	275,000	$5,000	807,125	$12,240	825,500	$12,500			61,875	$900
Mullet, salted	78.750	2,700	87,500	3,000	207.250	6,000	216,250	6,250	21,875	$625	26,250	750
Mullet roe, salted	4,000	200	4,800	240								
Total	344,000	7,650	367,300	8,240	1,014,375	18,240	1,041,750	18,750	21,875	625	88,125	1,650

Species.	Wakulla.				Franklin.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass, fresh	4,300	$86	5,000	$100								
Bluefish, fresh	900	53	850	50	6,700	$145	7,550	$164				
Bream and sunfish, fresh					10.000	500	12,000	600				
Channel bass, fresh	16,000	320	18,300	366	26,350	552	28,500	607				
Flounders, fresh	800	16	750	15								
Mullet, fresh	1,332,375	19,380	1,255,625	18,220	245,250	4,683	322,250	5,912	13,000	$325	12,000	$300
Mullet, salted	320,675	8,680	370,475	9.872	180,650	5,171	389,450	8,082	96,000	2,520	80,000	2,100
Mullet roe, salted	12,300	645	14,400	751	22,000	1,314	60,290	3,587	18,000	1,260	16,000	1,120
Pinfish, fresh	4,800	96	5,000	100								
Pompano, salted					1,500	53	1,800	63	6,500	163	3,000	82
Sea bass, fresh	3,200	64	3,500	70								
Sheepshead, fresh	13,750	275	14,920	307	22,430	476	25,500	542				
Snappers, red, fresh							2,000	50				
Spanish mack'l, fresh	600	36	500	30	500	12	300	8				
Spanish mackerel, salted					1.000	35	1,200	42				
Trout, fresh	13,200	292	13,600	303	37,910	821	44,625	971				
Trout, salted									13,490	338	6,400	176
Miscellaneous fish, fresh	5.200	156	6,000	180	17,000	850	16,000	800				
Miscellaneous fish, salted	31,500	484	28,600	429					5,000	125	3,100	85
Sponges	990	990	640	640	7,022	11,178	3,505	5,667				
Oysters	17,815	640	18,095	653	1,061.886	25,850	1,528,282	36,971				
Total	1,778,405	32,213	1,756,255	32,086	1,640,198	51,640	2,443,252	64,066	151,990	4,731	120,500	3,863

16.—Table showing by counties and species the yield of the fisheries of the west coast of Florida in 1889 and 1890—Continued.

Species.	Washington.				Santa Rosa.				Escambia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh	....	......	....	......	....	......	....	......	13,102	$184	40,465	$569
Bluefish, fresh	26,444	$510	17,241	$344	23,540	$454	15,501	$309	231,469	6,859	286,053	7,819
Bream and sunfish, fresh	2,079	21	2,275	23	1,783	17	1,950	19	11,997	181	21,863	324
Channel bass, fresh	3,136	42	2,584	35	3,781	56	3,491	47	25,495	459	40,595	853
Channel bass, salted	1,000	25	....	......	....	......	....	......	....	......	....	......
Croakers, fresh	....	......	....	......	....	......	....	......	36,368	565	42,923	650
Flounders, fresh	110	3	50	2	....	......	....	......	....	......	....	......
Groupers, fresh	9,500	95	33,500	335	6,060	60	4,690	47	321,262	3,217	315,541	3,158
Jurel, fresh	21,425	214	29,866	299	18,363	184	25,599	256	93,842	1,188	222,090	2,481
Lady-fish, fresh	4,929	49	4,847	48	4,225	42	4,741	48	89,592	896	84,996	910
Lady-fish, salted	22,800	684	22,000	660	....	......	....	......	....	......	....	......
Mullet, fresh	46,055	848	40,915	753	31,154	417	29,383	393	588,222	10,999	527,828	10,251
Mullet, salted	432,000	11,259	439,450	10,985	....	......	....	......	....	......	....	......
Mullet roe, salted	71,400	4,673	81,800	4,876	....	......	....	......	....	......	....	......
Pinfish, fresh	....	......	....	......	....	......	....	......	24,509	329	43,035	622
Pompano, fresh	4,016	597	5,086	521	4,737	622	6,901	662	79,107	15,825	62,369	13,225
Pompano, salted	50,600	1,732	24,700	785	....	......	....	......	....	......	....	......
Sheepshead, fresh	5,257	106	5,126	109	4,578	92	5,021	94	53,704	1,599	41,270	1,379
Silver perch, fresh	....	......	....	......	....	......	....	......	20,908	424	36,177	796
Snappers, red, fresh	85,000	2,375	100,260	2,811	42,186	1,432	47,280	1,773	3,242,184	96,756	3,997,402	118,015
Spanish mackerel, fresh	14,056	427	22,239	697	19,549	591	32,624	949	215,267	9,252	238,545	9,494
Spanish mackerel, salted	16,000	421	5,600	150	....	......	....	......	....	......	....	......
Spots, fresh	....	......	....	......	....	......	....	......	25,145	349	35,315	508
Trout, fresh	748	24	843	25	1,546	49	909	28	37,316	1,469	36,564	1,578
Trout, salted	83,950	2,075	44,950	1,166	....	......	....	......	....	......	....	......
Whiting, fresh	....	......	....	......	....	......	....	......	14,934	361	25,242	521
Miscellaneous fish, fresh	12,815	126	11,466	121	10,120	110	9,833	105	....	......	....	......
Miscellaneous fish, salted	52,000	1,345	32,200	863	....	......	....	......	....	......	....	......
Oysters	49,441	2,792	56,385	3,173	....	......	....	......	297,500	21,025	336,875	26,678
Turtles	100	2	....	......	740	21	7,000	140	740	21	2,250	53
Total	1,014,861	30,445	983,383	28,781	172,362	4,147	194,923	4,870	5,422,663	171,952	6,437,398	199,884

SUMMARY.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Amber-fish, fresh	60,000	$2,400	65,000	$2,600
Angel-fish, fresh	89,690	1,423	126,726	2,065
Black bass, fresh	4,300	86	5,000	100
Bluefish, fresh	364,397	9,315	420,046	10,398
Bream and sunfish, fresh	25,839	719	38,068	906
Channel bass, fresh	390,997	6,005	457,737	7,236
Channel bass, salted	1,000	25	....	......
Crevalle, fresh	17,280	346	18,024	287
Croakers, fresh	36,368	565	42,923	650
Drum, fresh-water, fresh	48,974	684	32,884	771
Drum, salt-water, fresh	102,305	1,478	121,853	1,898
Flounders, fresh	20,129	276	23,620	306
Groupers, fresh	417,322	6,462	398,731	4,490
Grunts, fresh	611,853	20,016	680,725	22,202
Jurel, fresh	167,616	2,149	314,840	3,998
Kingfish, fresh	456,231	16,747	291,725	12,625
Lady-fish, fresh	103,426	1,502	99,584	1,336
Lady-fish, salted	22,800	684	22,000	660
Mullet, fresh	8,794,398	97,690	10,656,958	115,572
Mullet, salted	2,728,783	83,306	2,988,254	80,184
Mullet, smoked	4,300	215	3,200	148
Mullet roe, salted	244,080	15,218	298,346	17,257
Pinfish, fresh	33,308	473	52,535	778
Pompano, fresh	267,683	26,306	258,036	24,498
Pompano, salted	76,062	3,048	41,300	1,879
Sailor's choice, fresh	58,205	$844	58,277	$856
Sea bass, fresh	5,200	124	5,700	136
Sheepshead, fresh	527,126	9,465	543,797	9,449
Silver perch, fresh	20,908	424	36,177	796
Snappers, red, fresh	3,469,370	105,357	4,172,942	123,799
Snappers, gray and others, fresh	45,867	927	47,365	967
Spanish mackerel, fresh	344,814	17,405	434,193	20,908
Spanish mackerel, salted	18,000	506	6,800	192
Spots, fresh	25,145	349	35,315	508
Trout, fresh	317,241	11,409	551,133	12,036
Trout, salted	97,440	2,413	51,550	1,342
Whiting, fresh	14,934	361	25,242	521
Miscellaneous fish, fresh	436,285	20,404	477,211	22,389
Miscellaneous fish, salted	93,300	2,054	67,900	1,457
Sponges	316,330	382,087	366,772	436,682
Oysters	2,064,087	73,189	2,307,567	83,682
Quahogs	7,330	747	7,330	747
Terrapins	5,000	125	4,186	130
Turtles	432,877	18,706	469,256	20,972
Turtle eggs	6,000	900	6,625	994
Tortoise shell	1,003	2,517	1,153	2,884
Total	23,897,240	945,843	27,415,562	1,064,139

Products of the vessel and shore fisheries.—In the foregoing discussion of the fisheries by counties the persons and apparatus employed in the vessel and shore fisheries were exhibited; it therefore only remains to present the products resulting from each of these branches.

Although the vessel fisheries of Florida are much more extensive than in any other Gulf State, they are considerably less important than the shore fisheries. Vessel fishing is prosecuted from eight counties, but it is relatively important only in Monroe and Escambia counties; in the former the sponge fishery and in the latter the red-snapper fishery take precedence.

In 1890 the vessel catch amounted to 5,287,210 pounds, valued at $427,762, this being a substantial increase over the previous year. The most important products of the vessel fisheries are sponges (the value of which was $254,737 in 1889 and $283,051 in 1890) and red snappers (the yield of which was worth $92,259 in 1889 and $115,371 in 1890). Table 17, which follows, is a detailed exhibition of the products of the vessel fisheries.

As shown in Table 18, the yield of the shore fisheries of Florida in 1889 was valued at $573,539, and in 1890 at $636,377, the marked advance in the latter year being chiefly due to an increase in the sponge and oyster fisheries. The most prominent products in 1890 were, in the order of their importance, mullet, worth $204,317; sponges, worth $155,631; oysters, worth $84,020; pompano, worth $24,597; grunts, worth $22,202, and turtles and their products, worth $19,923. Monroe County also ranks first in the extent of its shore fisheries, and Escambia County occupies the second position.

17.—*Table showing by counties and species the yield of the vessel fisheries of the west coast of Florida in 1889 and 1890.*

Species.	Monroe.				Manatee.				Hillsboro.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh					800	$12	850	$13				
Bluefish, fresh					1,800	36	2,000	40				
Channel bass, fresh					1,500	23	2,000	30				
Groupers, fresh	50,700	$2,490										
Mullet, fresh	51,500	386	55,900	$419	82,100	657	93,750	750				
Mullet, salted			15,000	600								
Mullet roe, salted			2,200	154								
Pompano, fresh					14,700	686	18,100	896				
Sailor's choice, fresh					750	11	800	12				
Sheepshead, fresh	1,000	15	1,200	18	12,500	188	15,000	225				
Spanish mackerel, fresh					6,250	281	8,075	363				
Trout, fresh	900	14	1,000	15	4,100	82	4,000	80				
Oysters									59,850	$2,386	7,875	$949
Quahogs	1,330	200	1,330	200								
Sponge	197,322	246,654	220,399	275,500								
Turtles	89,345	4,969	84,630	4,745								
Tortoise shell	3	10	3	9								
Total	392,100	254,738	381.662	281,660	124,500	1,976	144.575	2,409	59,850	2,386	7,875	949

17. Table showing by counties and species the yield of the vessel fisheries of the west coast of Florida in 1889 and 1890—Continued.

Species.	Levy.				Franklin.				Washington.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Channel bass, salted									1,000	$25		
Groupers, fresh									9,500	95	33,500	$335
Mullet, salted					26,650	$603	96,100	$2,168			50,200	1,246
Mullet roe, salted					2,800	168	11,090	715			7,000	490
Pompano, salted									23,600	1,042	8,200	312
Snappers, red, fresh							2,000	50	85,000	2,375	100,260	2,811
Spanish mackerel, salted									7,200	180	600	12
Trout, salted									10,000	250	5,800	141
Miscellaneous fish, salted									10,000	250	9,000	225
Oysters					128,800	3,018	156,100	3,670				
Sponges	82	$65	3,360	$4,200	5,047	8,018	2,100	3,351				
Total	82	65	3,360	4,200	163,297	11,807	267,390	9,954	146,300	4,217	214,560	5,572

Species	Santa Rosa.				Escambia.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh					1,013	$10	1,200	$12	1,813	$22	2,050	$25
Bluefish, fresh	873	$17	724	$14	12,348	246	10,974	218	15,021	290	13,698	272
Bream and sunfish, fresh					1,337	13	1,200	12	1,337	13	1,200	12
Channel bass, fresh	1,003	20	1,275	17	2,358	37	2,200	31	4,951	80	5,475	78
Channel bass, salted									1,000	25		
Croakers, fresh					1,181	12	1,200	12	1,181	12	1,200	12
Groupers, fresh	3,797	38	4,000	47	298,342	2,970	298,011	2,983	300,539	3,503	336,201	3,365
Jurel, fresh					18,013	180	18,000	180	18,913	189	18,000	180
Lady-fish, fresh			585	6	4,437	44	2,985	30	4,437	44	3,570	36
Mullet, fresh	250	3	100	2	35,341	300	22,500	300	150,391	1,596	172,290	1,471
Mullet, salted									26,650	603	161,300	4,614
Mullet roe, salted									2,800	168	36,290	1,359
Pinfish, fresh					1,350	13	1,200	12	1,350	13	1,200	12
Pompano, fresh	1,304	110	3,341	216	2,247	275	3,083	338	18,243	1,471	38,734	1,456
Pompano, salted									23,600	1,042	8,200	312
Sailor's choice, fresh									750	11	800	12
Sheepshead, fresh	71	2	625	13	1,352	26	1,827	27	14,528	261	18,654	295
Silver perch, fresh					720	11	800	12	720	11	800	12
Snappers, red, fresh	22,196	332	47,290	1,773	2,883,494	86,652	3,754,942	110,737	3,092,629	92,250	3,904,842	115,871
Spanish mackerel, fresh	6,500	225	18,500	497	8,445	200	11,689	330	22,185	755	38,274	1,249
Spanish mackerel, salted									7,200	180	600	12
Spots, fresh					1,620	16	1,585	16	1,620	16	1,585	16
Trout, fresh	904	27	185	6	1,579	45	750	20	7,488	171	5,985	121
Trout, salted									10,000	250	5,800	141
Miscellaneous fish, salted									10,000	250	9,000	225
Oysters					60,000	5,350	58,875	5,058	287,890	10,854	227,851	9,672
Quahogs									1,800	200	1,820	200
Sponges									302,430	254,737	225,854	288,650
Turtles	700	28	7,000	140	740	29	1,850	35	90,535	5,467	86,484	4,615
Tortoise-shell									8	36	5	9
Total	35,095	1,296	78,987	2,941	3,476,457	96,832	4,188,920	130,877	4,040,906	375,906	5,287,231	457,762

18.—Table showing by counties and species the yield of the shore fisheries of the west coast of Florida in 1889 and 1890.

Species.	Monroe.				Lee.				De Soto.			
	1889.		1890.		1889. *		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Amber-fish, fresh	60,000	$2,400	65,000	$2,600	......	......	......	......	......	......	......	......
Angel-fish, fresh	......	......	......	......	......	......	......	......	6,290	$79	6,000	$75
Channel bass, fresh	......	......	......	......	......	......	......	......	68,585	857	71,810	898
Drum, fresh-water, fresh	......	......	......	......	......	......	......	......	4,877	61	5,590	70
Drum, salt-water, fresh	......	......	......	......	......	......	......	......	6,110	77	7,285	91
Grunts, fresh	587,630	19,588	650,950	21,707	......	......	......	......	......	......	......	......
Kingfish, fresh	456,231	16,747	291,725	12,625	......	......	......	......	......	......	......	......
Lady-fish, fresh	4,680	515	5,000	550	......	......	......	......	......	......	......	......
Mullet, fresh	10,000	400	12,500	500	2,332	$350	2,663	$400	1,372,560	10,475	1,438,135	10,975
Mullet, salted	......	......	......	......	707,900	31,070	604,348	21,559	60,000	1,650	134,000	3,050
Mullet, smoked	......	......	......	......	3,000	150	2,000	100	......	......	......	......
Mullet, roe, salted	......	......	......	......	60,974	3,918	60,843	3,498	10,300	715	15,515	624
Pinfish, fresh	......	......	......	......	......	......	......	......	4,000	50	4,500	56
Pompano, fresh	......	......	......	......	......	......	......	......	54,286	3,257	56,945	3,411
Pompano, salted	......	......	......	......	2,350	353	3,500	525	......	......	......	......
Sailor's choice, fresh	......	......	......	......	......	......	......	......	5,440	68	5,825	73
Sheepshead, fresh	......	......	......	......	......	......	......	......	119,970	1,500	125,775	1,572
Snappers, red, fresh	100,000	5,000	20,000	1,000	......	......	......	......	......	......	......	......
Snappers, gray and other, fresh	1,000	125	1,000	125	......	......	......	......	5,318	67	4,360	55
Spanish mackerel, fresh	20,000	2,000	22,500	2,250	......	......	......	......	17,094	1,026	17,955	1,077
Trout, fresh	......	......	......	......	......	......	......	......	51,385	642	53,750	672
Miscellaneous fish, fresh	378,000	18,900	416,850	20,843	......	......	......	......	......	......	......	......
Sponges	110,273	121,300	138,068	151,875	......	......	......	......	......	......	......	......
Oysters	......	......	......	......	10,360	840	13,825	1,095	37,100	2,120	78,295	4,515
Quahogs	......	......	......	......	1,330	62	1,330	62	......	......	......	......
Turtles	197,747	7,267	207,174	7,607	3,500	280	3,000	240	......	......	4,000	320
Turtle eggs	3,600	540	4,200	630	......	......	......	......	......	......	......	......
Tortoise shell	1,000	2,500	1,150	2,875	......	......	......	......	......	......	......	......
Total	1,930,161	197,282	1,836,117	225,187	791,746	37,023	691,509	27,479	1,823,315	22,644	2,029,740	27,534

Species.	Manatee.				Hillsboro.				Pasco.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh	26,951	$517	29,682	$590	21,798	$319	29,929	$461	......	......	......	......
Bluefish, fresh	20,671	380	27,501	551	22,535	423	34,154	683	......	......	......	......
Channel bass, fresh	60,823	999	75,516	1,251	76,162	1,040	108,704	1,531	......	......	......	......
Crevalle, fresh	6,259	80	6,043	93	5,921	89	7,077	121	......	......	......	......
Drum, fresh-water, fresh	24,499	346	23,007	338	19,598	277	24,287	363	......	......	......	......
Drum, salt-water, fresh	19,842	274	26,703	405	15,688	217	29,473	464	......	......	......	......
Flounders, fresh	10,677	143	11,378	159	8,542	114	11,442	160	......	......	......	......
Groupers, fresh	......	......	......	......	30,000	600	35,000	700	......	......	......	......
Grunts, fresh	7,792	118	9,859	140	16,433	310	19,916	355	......	......	......	......
Jurel, fresh	10,904	174	11,516	191	11,016	208	14,081	263	......	......	......	......
Mullet, fresh	1,324,624	9,291	2,044,286	15,344	1,425,062	10,537	2,438,315	18,988	25,200	$297	121,700	$1,100
Mullet, salted	306,825	7,055	276,972	6,116	133,875	2,620	136,807	3,604	50,350	905	57,450	1,121
Mullet, smoked	......	......	......	......	1,500	65	1,200	48	......	......	......	......
Mullet roe, salted	33,650	1,885	27,400	1,320	5,900	330	10,955	870	......	......	......	......
Pompano, fresh	20,535	1,034	20,493	1,069	80,062	4,075	87,112	4,608	......	......	......	......
Pompano, salted	15,112	747	8,300	415	......	......	......	......	......	......	......	......
Sailor's choice, fresh	14,871	214	13,841	206	14,394	209	15,919	237	......	......	......	......
Sea bass, fresh	......	......	......	......	2,000	60	2,200	66	......	......	......	......
Sheepshead, fresh	61,110	1,182	64,262	1,297	80,477	1,165	102,938	1,494	......	......	......	......
Snappers, gray and others, fresh	16,739	310	17,539	340	13,810	205	17,104	257	......	......	......	......
Spanish mack'l, fresh	18,741	1,432	18,875	1,428	32,007	2,312	72,080	4,587	......	......	......	......
Spanish mack'l, salt	......	......	......	......	1,600	50	......	......	......	......	......	......
Trout, fresh	60,775	1,802	67,695	1,921	60,565	1,247	91,115	1,720	......	......	......	......
Miscellaneous fish, fresh	......	......	......	......	13,125	262	17,062	340	......	......	......	......
Miscellaneous fish, salted	......	......	......	......	5,000	100	4,000	80	......	......	......	......
Oysters	525	25	630	30	357,070	13,348	406,665	14,796	......	......	......	......
Quahogs	......	......	......	......	1,340	85	1,340	85	......	......	......	......
Turtles	60,000	1,400	60,000	1,400	10,000	150	10,244	170	......	......	......	......
Turtle eggs	665	100	665	100	1,735	260	1,760	264	......	......	......	......
Total	2,122,590	29,508	2,842,163	34,704	2,467,215	40,677	3,730,879	57,315	75,550	1,202	179,150	2,221

18.—Table showing by counties and species the yield of the shore fisheries of the west coast of Florida in 1889 and 1890—Continued.

Species.	Hernando.				Citrus.				Levy.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh									20,749	$312	19,800	$297
Bluefish, fresh									30,338	455	29,196	438
Channel bass, fresh	1,000	$15	1,800	$27	2,000	$50	2,300	$58	106,165	1,592	102,137	1,533
Crevalle, fresh									5,100	77	4,904	73
Drum, salt-water, fresh									60,665	910	58,392	876
Groupers, fresh											10,000	250
Jurel, fresh									12,066	181	11,688	176
Mullet, fresh	172,500	1,494	157,100	1,390	94,296	1,070	60,348	718	909,981	9,100	875,886	8,759
Mullet, salted	28,900	722	30,500	762	52,000	1,159	57,850	1,298	51,735	1,170	45,952	1,035
Mullet roe, salted									5,556	278	4,346	217
Pompano, fresh					1,250	50	550	22	9,000	450	1,500	75
Sailor's choice, fresh									22,750	342	21,892	328
Sheepshead, fresh	1,500	23	2,000	30	29,520	1,024	24,000	630	121,330	1,830	116,785	1,752
Snappers, red, fresh											6,000	150
Snappers, gray and others, fresh					9,000	230	7,300	190				
Spanish mackerel, fresh									750	36	500	25
Trout, fresh	5,000	75	7,500	112	16,300	342	10,540	231	227,496	4,550	218,972	4,380
Sponges									900	900	800	800
Oysters					27,125	969	34,440	1,230	145,425	5,194	116,200	3,602
Quahogs									3,330	400	3,330	400
Terrapins									5,000	125	4,180	130
Turtles									70,705	4,596	89,958	6,297
Total	208,900	2,329	198,900	2,321	231,491	4,884	197,328	4,377	1,809,041	32,488	1,742,418	31,593

Species.	Lafayette.				Taylor.				Jefferson.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Mullet, fresh	261,250	$4,750	275,000	$5,000	807,125	$12,240	825,500	$12,500			61,875	$900
Mullet, salted	78,750	2,700	87,500	3,000	207,250	6,000	216,250	6,250	21,875	$625	26,250	750
Mullet roe, salted	4,000	200	4,800	240								
Total	344,000	7,650	367,300	8,240	1,014,375	18,240	1,041,750	18,750	21,875	625	88,125	1,650

Species.	Wakulla.				Franklin.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass, fresh	4,300	$86	5,000	$100								
Bluefish, fresh	900	53	850	50	6,700	$145	7,550	$164				
Bream and sunfish, fresh					10,000	500	12,000	600				
Channel bass, fresh	16,000	320	18,300	366	26,350	552	28,500	607				
Flounders, fresh	800	16	750	15								
Mullet, fresh	1,332,375	19,380	1,255,625	18,220	245,250	4,683	322,250	5,912	13,000	$325	12,000	$300
Mullet, salted	320,675	8,680	370,475	9,872	154,000	4,568	283,350	5,914	96,000	2,520	80,000	2,100
Mullet roe, salted	12,300	645	14,400	751	19,200	1,146	49,200	2,872	18,000	1,260	16,000	1,120
Pinfish, fresh	4,800	96	5,000	100								
Pompano, salted					1,500	53	1,800	63	6,300	163	3,000	82
Sea bass, fresh	3,200	64	3,500	70								
Sheepshead, fresh	13,750	275	14,930	307	22,430	476	25,500	542				
Spanish mackerel, fresh	600	36	500	30	500	12	300	8				
Spanish mackerel, salted					1,000	35	1,200	42				
Trout, fresh	13,200	292	13,600	303	37,910	821	44,635	971				
Trout, salted									13,490	338	6,400	176
Miscellaneous fish, fresh	5,200	156	6,000	180	17,000	850	16,000	800				
Miscellaneous fish, salted	31,500	484	28,600	429					5,000	125	3,100	85
Sponges	990	990	640	640	1,975	3,160	1,405	2,316				
Oysters	17,815	640	18,095	653	933,086	22,832	1,372,182	33,301				
Total	1,778,405	32,213	1,756,355	32,086	1,476,901	39,833	2,175,862	54,112	151,790	4,731	120,500	3,863

18.--Table showing by counties and species the yield of the shore fisheries of the west coast of Florida in 1889 and 1890—Continued.

Species.	Washington.				Santa Rosa.				Escambia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh									12,089	$174	39,265	$557
Bluefish, fresh	26,444	$510	17,241	$344	22,667	$437	14,777	$295	219,121	6,613	275,079	7,601
Bream and sunfish, fresh	2,079	21	2,275	23	1,783	17	1,950	19	10,660	168	20,663	312
Channel bass, fresh	3,136	42	2,584	35	2,688	36	2,216	30	23,137	422	38,395	822
Croakers, fresh									35,187	553	41,723	638
Flounders, fresh	110	3	50	2								
Groupers, fresh					2,263	22			24,720	247	17,530	175
Jurel, fresh	21,425	214	29,866	299	18,363	184	25,599	256	74,929	999	204,090	2,301
Lady-fish, fresh	4,929	49	4,847	48	4,225	42	4,156	42	85,155	852	82,011	880
Lady-fish, salted	22,800	684	22,000	660								
Mullet, fresh	46,055	848	40,915	753	30,904	414	29,283	391	562,681	10,659	505,288	9,951
Mullet, salted	432,000	11,259	389,250	9,739								
Mullet roe, salted	71,400	4,673	74,800	4,386								
Pinfish, fresh									23,159	316	41,835	610
Pompano, fresh	4,016	597	5,086	521	3,443	512	4,360	446	76,860	15,550	59,286	12,887
Pompano, salted	27,000	690	16,500	473								
Sheepshead, fresh	5,257	106	5,126	109	4,507	90	4,394	81	52,452	1,572	39,443	1,342
Silver perch, fresh									20,188	413	35,377	784
Snappers, red, fresh					20,000	600			256,750	7,698	242,600	7,278
Spanish mackerel, fresh	14,056	427	22,239	697	12,049	366	19,064	542	206,822	9,003	226,906	9,155
Spanish mackerel, salted	8,800	241	5,000	138								
Spots, fresh									23,525	333	33,730	490
Trout, fresh	748	24	843	25	642	22	724	22	35,737	1,421	35,814	1,558
Trout, salted	73,950	1,825	39,150	1,025								
Whiting, fresh									14,934	361	25,242	521
Miscellaneous fish, fresh	12,815	126	11,466	121	10,120	110	9,833	105				
Miscellaneous fish, salted	42,000	1,095	23,200	638								
Oysters	49,441	2,792	56,385	3,173					248,500	15,775	283,500	21,625
Turtles	100	2									400	20
Total	868,561	26,228	768,823	23,209	133,654	2,852	116,356	2,229	2,006,606	73,130	2,248,177	79,507

SUMMARY.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Amber-fish, fresh	60,000	$2,400	65,000	$2,600
Angel-fish, fresh	87,877	1,401	124,676	1,980
Black bass, fresh	4,300	86	5,000	100
Bluefish, fresh	349,376	9,016	406,348	10,126
Bream and sunfish, fresh	24,522	706	36,888	954
Channel bass, fresh	386,046	5,925	452,262	7,158
Crevalle, fresh	17,280	246	18,024	287
Croakers, fresh	35,187	553	41,723	638
Drum, fresh-water, fresh	48,974	684	52,884	771
Drum, salt-water, fresh	102,305	1,478	121,853	1,836
Flounders, fresh	20,129	276	23,620	336
Groupers, fresh	56,983	869	62,530	1,125
Grunts, fresh	611,855	20,016	680,725	22,202
Jurel, fresh	148,703	1,960	296,840	3,486
Kingfish, fresh	456,231	16,747	291,725	12,625
Lady-fish, fresh	98,989	1,458	96,014	1,520
Lady-fish, salted	22,800	684	22,000	660
Mullet, fresh	8,635,195	96,313	10,478,669	112,101
Mullet, salted	2,702,135	82,703	2,806,954	76,170
Mullet, smoked	4,500	215	3,200	148
Mullet roe, salted	241,280	15,050	278,259	15,898
Pinfish, fresh	31,959	462	51,335	766
Pompano, fresh	249,452	25,525	235,332	23,039
Pompano, salted	52,462	2,006	33,100	1,558
Sailor's choice, fresh	57,455	833	57,477	844
Sea bass, fresh	5,200	$124	5,700	$136
Sheepshead, fresh	512,303	9,234	525,143	9,156
Silver perch, fresh	20,188	413	35,377	784
Snappers, red, fresh	376,750	13,298	268,600	8,428
Snappers, gray and others, fresh	45,867	927	47,303	967
Spanish mackerel, fresh	322,619	16,650	400,919	19,799
Spanish mackerel, salted	11,400	326	6,200	180
Spots, fresh	23,525	333	33,730	490
Trout, fresh	509,758	11,238	545,178	11,915
Trout, salted	87,440	2,163	45,550	1,201
Whiting, fresh	14,934	361	25,242	521
Miscellaneous fish, fresh	436,260	20,404	477,211	22,389
Miscellaneous fish, salted	83,500	1,804	58,900	1,232
Sponges	114,138	126,350	140,913	155,631
Oysters	1,826,447	64,535	2,380,217	84,020
Quahogs	6,000	547	6,000	547
Terrapins	5,000	125	4,180	130
Turtles	342,052	13,695	374,776	16,054
Turtle eggs	6,000	900	6,625	994
Tortoise shell	1,000	2,500	1,150	2,875
Total	19,256,376	573,539	22,131,352	636,377

Vessel fisheries by customs districts.—The west coast of Florida is occupied by five customs districts, viz, Key West, Tampa, St. Marks, Apalachicola, and Pensacola. The importance of the vessel fisheries of the State justifies the presentation of the following special tables, showing the extent of the fishing done by craft taking out licenses in each of these districts.

19.—Summary by customs districts of the vessel fisheries of the west coast of Florida in 1889 and 1890.

FISHING VESSELS.

Customs districts.	Number and nationality of fishermen.															
	1889.								1890.							
	Americans.	British provincials.	Spaniards.	French.	Portuguese.	Norwegians.	Others.	Total.	Americans.	British provincials.	Spaniards.	French.	Portuguese.	Norwegians.	Others.	Total.
Key West	127	525	8					660	141	572	4					717
Tampa	10							10	5							5
St. Marks	6	7						13	16	13						29
Apalachicola	62							62	49							49
Pensacola	117	8	10	5	30	23	14	207	129	13	10	3	29	23	23	230
Total	322	540	18	5	30	23	14	952	340	598	14	3	29	23	23	1, 030

Customs districts.	Number of vessels fishing.		Net tonnage.		Value of vessels.		Value of outfit, gear, provisions, fuel, etc.		Value of catch.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Key West	81	88	1, 159. 83	1, 187. 08	$124, 900	$128, 470	$75, 450	$80, 826	$254, 738	$281, 660
Tampa	3	2	53. 83	17. 40	4, 900	900	962	607	4, 362	3, 358
St. Marks	1	3	18. 50	42. 57	2, 250	5, 050	792	1, 877	65	4. 200
Apalachicola	12	12	93. 26	86. 70	6, 150	5, 750	2, 533	2, 376	11, 807	9, 954
Pensacola	35	40	871. 19	1, 022. 92	63, 000	73, 820	51, 033	59, 587	104, 334	128, 590
Total	132	145	2, 196. 61	2, 356. 67	201, 200	213, 990	130, 770	145, 273	375, 306	427, 762

TRANSPORTING VESSELS.

Customs districts.	No. of vessels transporting.		Net tonnage.		Value of vessels.		Value of provisions, fuel, etc.		Number and nationality of crew.								Value of products transported.	
									1889.				1890.					
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	Americans.	British provincials.	Spaniards.	Total.	Americans.	British provincials.	Spaniards.	Total.	1889.	1890.
Key West	5	7	94. 99	134. 56	$7, 800	$11, 300	$1, 070	$1, 570	8	4	4	16	12	7	5	24	$25, 460	$29, 326
Tampa	9	9	88. 82	88. 82	12, 050	12, 050	2, 640	2, 730	22			22	22			22	30, 000	40, 000
St. Marks	1	3	5. 19	19. 50	500	2, 100	125	325	2			2	6			6	7, 500	12, 500
Apalachicola	2	1	31. 15	16. 92	1, 400	800	190	90	4			4	3			3	1, 630	2, 155
Pensacola	1	1	20. 41	20. 41	2, 000	1, 500	120	50					*[3]			[3]	1, 800	1, 975
Total	18	21	240. 56	280. 21	23, 750	27, 750	4, 145	4, 765	36	4	4	44	43	7	5	55	66, 390	85, 956

* Employed also in the shore fisheries and there enumerated.

20.—*Table showing by customs districts and species the yield of the vessel fisheries of the west coast of Florida in 1889 and 1890.*

Species.	Key West.				Tampa.				St. Marks.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh					800	$12	850	$13				
Bluefish, fresh					1,800	36	2,000	40				
Channel bass, fresh					1,500	23	2,000	30				
Groupers, fresh	50,700	$2,490										
Mullet, fresh	51,500	386	55,900	$419	82,100	657	93,750	750				
Mullet, salted			15,000	600								
Mullet roe, salted			2,200	154								
Pompano, fresh					14,700	686	18,100	896				
Sailor's choice, fresh					750	11	800	12				
Sheepshead, fresh	1,000	15	1,200	18	12,500	188	15,000	225				
Spanish mackerel, fresh					6,250	281	8,075	363				
Trout, fresh	900	14	1,000	15	4,100	82	4,000	80				
Sponges	197,322	246,654	220,399	275,500					52	$65	3,360	$4,200
Oysters					59,850	2,386	7,875	949				
Quahogs	1,330	200	1,330	200								
Turtles	89,345	4,969	84,630	4,745								
Tortoise shell	3	10	3	9								
Total	392,100	254,738	381,662	281,660	184,350	4,362	152,450	3,358	52	65	3,360	4,200

Species.	Apalachicola.				Pensacola.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish, fresh					1,013	$10	1,200	$12	1,813	$22	2,050	$25
Bluefish, fresh					13,221	263	11,698	232	15,021	299	13,698	272
Bream and sunfish, fresh					1,337	13	1,200	12	1,337	13	1,200	12
Channel bass, fresh					3,451	57	3,475	48	4,951	80	5,475	78
Channel bass, salted					1,000	25			1,000	25		
Croaker, fresh					1,181	12	1,200	12	1,181	12	1,200	12
Groupers, fresh					309,839	3,103	336,201	3,365	360,539	5,593	336,201	3,365
Jurel, fresh					18,913	189	18,000	180	18,913	189	18,000	180
Lady-fish, fresh					4,437	44	3,570	36	4,437	44	3,570	36
Mullet, fresh					25,791	343	22,640	302	159,391	1,386	172,290	1,471
Mullet, salted	26,650	$603	96,100	$2,168			50,200	1,246	26,650	603	161,300	4,014
Mullet roe, salted	2,800	168	11,090	715			7,000	490	2,800	168	20,290	1,359
Pinfish, fresh					1,350	13	1,200	12	1,350	13	1,200	12
Pompano, fresh					3,541	385	5,624	554	18,241	1,071	23,724	1,450
Pompano, salted					23,600	1,042	8,200	312	23,600	1,042	8,200	312
Sailor's choice, fresh									750	11	800	12
Sheepshead, fresh					1,323	28	2,454	50	14,823	231	18,654	293
Silver perch, fresh					720	11	800	12	720	11	800	12
Snappers, red, fresh			2,000	50	3,092,620	92,259	3,902,342	115,321	3,092,620	92,259	3,904,342	115,371
Spanish mackerel, fresh					15,945	474	25,199	746	22,195	755	33,274	1,109
Spanish mackerel, salted					7,200	180	600	12	7,200	180	600	12
Spots, fresh					1,620	16	1,585	18	1,620	16	1,585	18
Trout, fresh					2,483	75	935	26	7,483	171	5,935	121
Trout, salted					10,000	250	5,800	141	10,000	350	5,800	141
Miscellaneous fish, salted					10,000	250	9,000	225	10,000	250	9,000	225
Sponges	5,047	8,018	2,100	3,351					202,421	254,737	225,859	283,051
Oysters	128,800	3,018	156,100	3,670	49,000	5,250	53,375	5,053	237,650	10,654	217,350	9,672
Quahogs									1,330	200	1,330	200
Turtle					1,480	42	8,850	173	90,825	5,011	93,480	4,918
Tortoise shell									3	10	3	9
Total	163,297	11,807	267,390	9,954	3,601,065	104,334	4,482,348	128,590	4,340,864	375,306	5,287,210	427,762

Fisheries by apparatus.—The quantity and value of products taken with each of the principal forms of apparatus are shown in Tables 21 and 22, which relate to the vessel and shore fisheries respectively. The variety of apparatus employed in the fisheries of Florida is very limited, consisting principally of seines, gill nets, and lines for the capture of fish proper, together with a few cast nets and other minor forms.

In the vessel fisheries much the largest catch of fish is made with lines; in 1890 4,240,688 pounds, valued at $118,738, were obtained in this way, of which 3,904,342 pounds, worth $115,371, were red snappers. Gill nets rank next in importance, taking 309,865 pounds in 1890, for which the fishermen received $5,744; mullet is the only important species thus captured. Seines secure the greatest number of species, and took 198,635 pounds, valued at $5,430, of which the most prominent fish were mullet and Spanish mackerel. Such miscellaneous apparatus as dredges, rakes, tongs, and hooks took oysters, quahogs, and sponges to the value of $292,923. A special form of net was employed for turtles, the value of which was $4,927.

Gill nets are the most important means of capture in the shore or boat fisheries of the State. In 1890, 11,073,639 pounds, worth $153,956, were thus secured. Mullet is the most prominent fish taken in gill nets, but considerable quantities of pompano, sheepshead, and trout are also obtained. The seine catch is only about one-half the gill-net yield, but has a value nearly as great; in addition to mullet, which constitutes the principal part of the catch, bluefish, pompano, and Spanish mackerel are important species. The product of the line fishery amounted to 1,930,315 pounds in 1890, with a value of $75,208, grunts, kingfish, and snappers being the principal species caught. Cast nets and other minor nets and traps are credited with taking 119,300 pounds, worth $3,208. The invertebrates and reptiles secured with miscellaneous devices, as tongs, hooks, etc., had a value of $260,251 in 1890.

61.—Table showing by counties and apparatus the yield of the vessel fisheries of the west coast of Florida in 1889 and 1890.

Apparatus and species.	Monroe.				Manatee.				Hillsboro.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Mullet, salted			15,000	$600								
Mullet roe, salted			2,200	184								
Total			17,200	784								
Gill nets:												
Angel-fish, fresh					800	$12	850	$13				
Bluefish, fresh					1,800	36	2,000	40				
Channel bass, fresh					1,500	23	2,000	30				
Mullet, fresh	51,500	$386	55,900	419	82,100	657	93,750	750				
Pompano, fresh					14,700	686	18,100	896				
Sailor's choice, fr'h					750	11	800	12				
Sheepshead, fresh	1,000	15	1,200	18	12,500	188	15,000	225				
Spanish mackerel, fresh					6,250	281	8,073	363				
Trout, fresh	900	14	1,000	15	4,100	82	4,000	80				
Total	53,400	415	58,100	452	124,500	1,976	144,573	2,409				
Lines:												
Groupers, fresh	50,700	2,490										
Miscellaneous:												
Oysters									38,830	$2,386	7,873	$949
Quahogs	1,330	200	1,330	200								
Sponges	197,329	246,654	220,300	275,500								
Turtles	89,338	4,969	84,630	4,745								
Tortoise shell	3	10	3	9								
Total	288,000	251,833	306,263	280,454					38,830	2,386	7,873	949
Grand total	392,100	254,738	381,563	281,690	124,500	1,976	144,573	2,409	38,830	2,386	7,873	949

21.—*Table showing by counties and apparatus the yield of the vessel fisheries of the west coast of Florida in 1889 and 1890*—Continued.

Apparatus and species.	Levy.				Franklin.				Washington.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Channel bass, salted	......	......	......	......	......	......	......	......	1,000	$25	......	......
Mullet, salted	......	......	......	......	7,650	$153	......	......	......	......	50,200	$1,246
Mullet roe, salted	......	......	......	......	1,000	60	......	......	......	......	7,000	490
Pompano, salted	......	......	......	......	......	......	......	......	23,600	1,042	8,200	312
Spanish mackerel, salted	......	......	......	......	......	......	......	......	7,200	180	600	12
Trout, salted	......	......	......	......	......	......	......	......	10,000	250	5,800	141
Miscellaneous fish, salted	......	......	......	......	......	......	......	......	10,000	250	9,000	225
Total	......	......	......	......	8,650	213	......	......	51,800	1,747	80,800	2,426
Gill nets:												
Mullet, salted	......	......	......	......	19,000	450	96,100	$2,168	......	......	......	......
Mullet roe, salted	......	......	......	......	1,800	108	11,090	715	......	......	......	......
Total	......	......	......	......	20,800	558	107,190	2,883	......	......	......	......
Lines:												
Groupers, fresh	......	......	......	......	......	......	......	......	9,500	95	33,500	335
Snappers, red, fresh	......	......	......	......	......	......	2,000	50	85,000	2,375	100,260	2,811
Total	......	......	......	......	......	......	2,000	50	94,500	2,470	133,760	3,146
Miscellaneous:												
Oysters	......	......	......	......	128,800	3,018	156,100	3,670	......	......	......	......
Sponges	52	$65	3,360	$4,200	5,047	8,018	2,100	3,351	......	......	......	......
Total	52	65	3,360	4,200	133,847	11,036	158,200	7,021	......	......	......	......
Grand total	52	65	3,360	4,200	163,297	11,807	267,390	9,954	146,300	4,217	214,560	5,572

Apparatus and species.	Santa Rosa.				Escambia.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Angel-fish, fresh	......	......	......	......	1,013	$10	1,200	$12	1,013	$10	1,200	$12
Bluefish, fresh	873	$17	724	$14	12,348	246	10,974	218	13,221	263	11,698	232
Bream and sunfish, fresh	......	......	......	......	1,337	13	1,200	12	1,337	13	1,200	12
Channel bass, fresh	1,093	20	1,275	17	2,358	37	2,055	29	3,451	57	3,330	46
Channel bass, salted	......	......	......	......	......	......	......	......	1,000	25	......	......
Croakers, fresh	......	......	......	......	1,181	12	1,200	12	1,181	12	1,200	12
Jurel, fresh	......	......	......	......	18,913	189	18,000	180	18,913	189	18,000	180
Lady-fish, fresh	......	......	585	6	4,437	44	2,985	30	4,437	44	3,570	36
Mullet, fresh	250	3	100	2	25,541	340	22,540	300	25,791	343	22,640	302
Mullet, salted	......	......	......	......	......	......	......	......	7,650	153	65,200	1,846
Mullet roe, salted	......	......	......	......	......	......	......	......	1,000	60	9,200	644
Pinfish, fresh	......	......	......	......	1,350	13	1,200	12	1,350	13	1,200	12
Pompano, fresh	1,294	110	2,541	216	2,247	275	3,083	338	3,541	385	5,624	554
Pompano, salted	......	......	......	......	......	......	......	......	23,600	1,042	8,200	312
Sheepshead, fresh	71	2	627	13	1,252	26	1,827	37	1,323	28	2,454	50
Silver perch, fresh	......	......	......	......	720	11	800	12	720	11	800	12
Spanish mackerel, fresh	7,500	225	13,560	407	8,445	249	11,639	339	15,945	474	25,199	746
Spanish mackerel, salted	......	......	......	......	......	......	......	......	7,200	180	600	12
Spots, fresh	......	......	......	......	1,620	16	1,585	18	1,620	16	1,585	18
Trout, fresh	904	27	185	6	1,579	48	750	20	2,483	75	935	26
Trout, salted	......	......	......	......	......	......	......	......	10,000	250	5,800	141
Miscellaneous fish, salted	......	......	......	......	......	......	......	......	10,000	250	9,000	225
Total	11,985	404	19,597	681	84,341	1,529	81,038	1,569	156,776	3,893	198,635	5,430

[illegible]. *Table showing by counties and apparatus the yield of the vessel fisheries of the west coast of Florida in 1880 and 1890*—Continued.

Apparatus and species.	Santa Rosa.				Escambia.				Total.			
	1880.		1890.		1880.		1890.		1880.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:												
Angel fish, fresh									400	[illegible]	450	[illegible]
Bluefish, fresh									[illegible]	[illegible]	2,000	[illegible]
Channel bass, fresh									1,500	[illegible]	2,000	[illegible]
Mullet, fresh									[illegible]	[illegible]	[illegible]	[illegible]
Mullet, salted									10,000	[illegible]	[illegible]	[illegible]
Mullet roe, salted									[illegible]	[illegible]	[illegible]	[illegible]
Pompano, fresh									[illegible]	[illegible]	[illegible]	[illegible]
Sailor's choice, fresh									[illegible]	[illegible]	400	[illegible]
Sheepshead, fresh									13,500	203	18,300	[illegible]
Spanish mackerel, fresh									4,250	[illegible]	4,175	[illegible]
Trout, fresh									5,000	[illegible]	[illegible]	[illegible]
Total									[illegible]	[illegible]	[illegible]	[illegible]
Lines:												
Channel bass, fresh							145	[illegible]			145	2
Groupers, fresh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	208,011	[illegible]	[illegible]	3,503	338,201	[illegible]
Snappers, red, fresh	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2,734,202	110,737	3,002,620	92,250	3,904,342	115,371
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	113,722	[illegible]	[illegible]	[illegible]	[illegible]
Miscellaneous:												
Oysters					40,000	[illegible]	[illegible]	[illegible]	[illegible]	10,654	217,350	9,672
Quahaugs									1,330	200	1,330	200
Sponges									202,421	254,737	225,859	283,061
Turtles	740	21	7,000	140	740	21	1,850	[illegible]	90,825	5,011	93,480	4,918
Tortoise shell									3	10	3	9
Total	740	21	7,000	140	40,740	5,271	[illegible]	[illegible]	532,229	270,612	[illegible]	297,850
Grand total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4,189,221	120,377	4,340,864	375,306	5,287,210	427,762

[illegible]. *Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1880 and 1890.*

Apparatus and species.	Monroe.				Lee.				De Soto.			
	1880.		1890.		1880.		1890.		1880.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
[illegible] fish, fresh	4,000	[illegible]	[illegible]	[illegible]								
Mullet, salted					707,000	[illegible]	[illegible]	$21,310	60,000	$1,650	134,000	$3,050
Mullet roe, salted					[illegible]	[illegible]	[illegible]	3,498	10,000	700	15,200	608
Pompano, salted					[illegible]	[illegible]	[illegible]	525				
Total	4,000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70,000	2,350	149,200	3,658
Gill nets:												
Angel fish, fresh									6,200	79	6,000	75
Channel bass, fresh									[illegible]	857	71,810	898
Drum, fresh-water, fresh									4,877	61	5,590	70
Drum, salt-water, fresh									6,110	77	7,285	91
Mullet, fresh					[illegible]	[illegible]	[illegible]	400	[illegible]	10,475	1,438,135	10,975
Mullet, salted							[illegible]	240				
Mullet roe, salted									300	15	315	16
[illegible], fresh									4,000	50	4,500	56
Pompano, fresh									34,288	3,237	36,945	3,411
Sailor's choice, fresh									5,440	68	5,825	73
Sheepshead, fresh									118,870	1,500	125,775	1,572
Snappers, [illegible] and others, fresh									[illegible]	[illegible]	[illegible]	55
Spanish mackerel, fresh									[illegible]	[illegible]	[illegible]	[illegible]
Trout, fresh									[illegible]	[illegible]	[illegible]	[illegible]
Total					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

22.—Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1889 and 1890—Continued.

Apparatus and species.	Monroe.				Lee.				De Soto.			
	1889.		1890.		1889		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cast nets and minor nets:												
Grunts, fresh	800	$27	950	$32								
Mullet, fresh	10,000	400	12,500	500								
Mullet, smoked					3,000	$150	2,000	$100				
Snappers, gray and others, fresh	1,000	125	1,000	125								
Miscellaneous fish, fresh	10,000	500	10,350	518								
Total	21,800	1,052	24,800	1,175	3,000	150	2,000	100				
Lines:												
Amber-fish, fresh	60,000	2,400	65,000	2,600								
Grunts, fresh	586,830	19,561	650,000	21,675								
Kingfish, fresh	456,231	16,747	291,725	12,625								
Snappers, red, fresh	100,000	5,000	20,000	1,000								
Spanish mackerel, fresh	20,000	2,000	22,500	2,250								
Miscellaneous fish, fresh	368,000	18,400	406,500	20,325								
Total	1,591,061	64,108	1,455,725	60,475								
Miscellaneous:												
Sponges	110,273	121,300	138,068	151,875								
Oysters					10,360	840	13,825	1,095	37,100	$2,120	78,295	$4,515
Quahogs					1,330	62	1,330	62				
Turtles	197,747	7,267	207,174	7,607	3,500	280	3,000	240			4,000	320
Turtle eggs	3,600	540	4,200	630								
Tortoise shell	1,000	2,500	1,150	2,875								
Total	312,620	131,607	350,592	162,987	15,190	1,182	18,155	1,397	37,100	2,120	82,295	4,835
Grand total	1,930,161	197,282	1,836,117	225,187	791,746	37,023	691,509	27,479	1,823,315	22,644	2,029,740	27,534

Apparatus and species.	Manatee.				Hillsboro.				Pasco.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Angel-fish, fresh	6,751	$99	8,623	$131	5,093	$74	7,346	$111				
Bluefish, fresh	5,938	109	9,234	185	4,480	82	7,865	157				
Channel bass, fresh	32,032	435	41,662	592	24,612	334	35,924	509				
Crevalle, fresh	1,798	23	2,029	31	1,493	22	1,849	30				
Drum, fresh-water, fresh	7,037	99	7,724	113	5,310	75	6,580	97				
Drum, salt-water, fresh	8,586	123	12,765	194	6,478	93	10,873	165				
Flounders, fresh	3,067	41	3,820	53	2,315	31	3,254	46				
Grunts, fresh	2,238	34	3,310	47	1,944	33	3,060	46				
Jurel, fresh	3,132	50	3,866	64	2,707	48	3,593	63				
Mullet, fresh	371,890	2,617	676,276	5,091	287,640	2,025	584,716	4,401				
Mullet, salted	208,660	4,687	193,438	4,084	44,125	982	56,230	1,500				
Mullet roe, salted	27,200	1,562	20,200	960	1,810	101	1,804	101				
Pompano, fresh	5,272	266	5,589	292	4,277	227	5,261	293				
Pompano, salted	912	37										
Sailor's choice, fresh	4,272	62	4,647	69	3,222	46	3,958	59				
Sheepshead, fresh	14,538	189	16,387	225	11,518	158	14,495	206				
Snappers, gray and others, fresh	4,205	59	5,042	72	3,173	44	4,295	62				
Spanish mackerel, fresh	14,410	1,101	14,288	1,081	9,213	704	12,172	921				
Spanish mackerel, salted					1,600	50						
Trout, fresh	11,483	219	15,593	288	10,039	206	14,624	281				
Miscellaneous fish, salted					750	12	480	10				
Total	733,421	11,812	1,044,493	13,572	431,799	5,347	778,379	9,058				

22.—*Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1889 and 1890*—Continued.

Apparatus and species.	Manatee.				Hillsborough.				Pasco.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:												
Angel-fish, fresh	16,750	$245	17,050	$259	16,795	$245	22,583	$350	....	....	....	....
Bluefish, fresh	14,735	271	18,287	306	18,455	341	25,290	328	....	....	....	....
Channel bass, fresh	24,941	326	28,854	400	51,550	696	66,456	948	....	....	....	....
Cavalla, fresh	4,061	57	4,854	62	4,428	67	5,228	91	....	....	....	....
Drum, fresh-water, fresh	17,602	287	15,293	225	14,299	202	17,767	266	....	....	....	....
Drum, salt-water, fresh	11,256	151	13,998	231	9,210	124	18,600	290	....	....	....	....
Flounders, fresh	7,610	102	7,558	106	6,227	83	8,188	114	....	....	....	....
Grunts, fresh	5,564	84	6,549	98	5,369	107	8,656	149	....	....	....	....
Jurel, fresh	7,772	124	7,650	127	8,260	150	10,488	200	....	....	....	....
Mullet, fresh	952,734	6,674	1,368,050	10,250	1,069,047	7,726	1,818,161	13,879	25,200	$297	121,700	$1,100
Mullet, salted	98,165	2,368	88,594	2,032	89,750	1,658	90,577	2,104	50,350	905	57,450	1,121
Mullet, smoked	....	....	....	....	1,540	65	1,200	48	....	....	....	....
Mullet roe, salted	6,450	323	7,200	360	4,060	229	9,151	769	....	....	....	....
Pompano, fresh	15,208	768	14,904	777	75,795	3,848	81,851	4,315	....	....	....	....
Pompano, salted	14,200	710	8,300	415	....	....	....	....	....	....	....	....
Sailor's choice, fresh	10,500	152	9,194	137	11,172	163	11,961	178	....	....	....	....
Sea bass, fresh	....	....	....	....	2,000	60	2,200	66	....	....	....	....
Sheepshead, fresh	36,072	468	36,475	502	69,959	1,007	70,163	1,059	....	....	....	....
Snappers, gray and others, fresh	10,434	146	9,907	143	8,597	119	10,800	155	....	....	....	....
Spanish mackerel, fresh	4,331	331	4,587	347	22,794	1,608	32,458	2,293	....	....	....	....
Trout, fresh	28,492	543	30,852	570	50,526	1,041	64,141	1,285	....	....	....	....
Miscellaneous fish, salted	....	....	....	....	4,250	88	3,520	70	....	....	....	....
Total	1,286,979	14,090	1,692,225	17,394	1,572,171	19,627	2,370,981	29,164	75,550	1,202	179,150	2,221
Cast nets and minor nets:												
Mullet, fresh	....	....	....	....	39,375	786	35,438	708	....	....	....	....
Miscellaneous fish, fresh	....	....	....	....	13,125	262	17,062	340	....	....	....	....
Total	....	....	....	....	52,500	1,048	52,500	1,048	....	....	....	....
Lines:												
Angel-fish, fresh	3,450	173	4,000	200	....	....	....	....	....	....	....	....
Channel bass, fresh	4,750	238	5,000	250	....	....	5,930	74	....	....	....	....
Groupers, fresh	....	....	....	....	30,000	600	35,000	700	....	....	....	....
Grunts, fresh	....	....	....	....	8,500	170	8,000	160	....	....	....	....
Sheepshead, fresh	10,500	525	11,400	570	....	....	18,280	229	....	....	....	....
Snappers, gray and others, fresh	2,100	105	2,500	125	2,100	42	2,000	40	....	....	....	....
Spanish mackerel, fresh	....	....	....	....	....	....	27,450	1,373	....	....	....	....
Trout, fresh	20,800	1,040	21,250	1,063	....	....	12,350	154	....	....	....	....
Total	41,600	2,081	44,150	2,208	40,600	812	109,010	2,730	....	....	....	....
Miscellaneous:												
Oysters	525	25	630	30	357,070	13,348	406,665	14,796	....	....	....	....
Quahogs	....	....	....	....	1,340	85	1,340	85	....	....	....	....
Turtles	60,000	1,400	60,000	1,400	10,000	150	10,244	170	....	....	....	....
Turtle eggs	665	100	665	100	1,735	260	1,760	264	....	....	....	....
Total	61,190	1,525	61,295	1,530	370,145	13,843	420,009	15,315	....	....	....	....
Grand total	2,122,580	20,808	2,842,163	34,704	2,467,215	40,677	3,730,879	57,315	75,550	1,202	179,150	2,221

22.—*Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1889 and 1890*—Continued.

Apparatus and species.	Hernando.				Citrus.				Levy.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Angel-fish, fresh	......	......	......	......	......	......	......	......	1,500	$23	3,000	$45
Bluefish, fresh	......	......	......	......	......	......	......	......	2,000	30	6,379	96
Channel bass, fresh	......	......	......	......	......	......	......	......	10,360	155	20,500	308
Crevalle, fresh	......	......	......	......	......	......	......	......	700	11	1,560	23
Drum, salt-water, fresh	......	......	......	......	......	......	......	......	7,600	114	10,758	161
Jurel, fresh	......	......	......	......	......	......	......	......	1,000	15	2,100	32
Mullet, fresh	......	......	......	......	......	......	......	......	49,500	495	131,382	1,314
Pompano, fresh	......	......	......	......	......	......	......	......	6,000	300	......	......
Sailor's choice, fresh	......	......	......	......	......	......	......	......	1,500	23	4,200	63
Sheepshead, fresh	......	......	......	......	......	......	......	......	7,500	113	17,850	268
Trout, fresh	......	......	......	......	......	......	......	......	15,000	300	32,845	657
Total	......	......	......	......	......	......	......	......	102,660	1,579	230,574	2,967
Gill nets:												
Angel-fish, fresh	......	......	......	......	......	......	......	......	19,249	289	16,800	252
Bluefish, fresh	......	......	......	......	......	......	......	......	28,338	425	22,817	342
Channel bass, fresh	1,000	$15	1,800	$27	1,500	$30	1,700	$34	95,805	1,437	81,637	1,225
Crevalle, fresh	......	......	......	......	......	......	......	......	4,400	66	3,344	50
Drum, salt-water, fresh	......	......	......	......	......	......	......	......	53,065	796	47,634	715
Jurel, fresh	......	......	......	......	......	......	......	......	11,066	166	9,588	144
Mullet, fresh	172,500	1,494	157,100	1,390	94,296	1,070	60,348	718	860,481	8,605	744,504	7,445
Mullet, salted	28,900	722	30,500	762	52,000	1,159	57,850	1,298	51,735	1,170	45,952	1,035
Mullet roe, salted	......	......	......	......	......	......	......	......	5,556	278	4,346	217
Pompano, fresh	......	......	......	......	1,250	50	550	22	3,000	150	1,500	75
Sailor's choice, fresh	......	......	......	......	......	......	......	......	21,250	319	17,692	265
Sheepshead, fresh	1,500	23	2,000	30	22,520	744	16,500	330	113,830	1,707	98,935	1,484
Snappers, gray and others, fresh	......	......	......	......	7,000	140	5,100	102	......	......	......	......
Spanish mackerel, fresh	......	......	......	......	......	......	......	......	750	36	500	25
Trout, fresh	5,000	75	7,500	112	15,500	310	9,540	191	212,496	4,250	186,127	3,723
Total	208,900	2,329	198,900	2,321	194,066	3,503	151,588	2,695	1,481,021	19,694	1,281,376	16,997
Lines:												
Channel bass, fresh	......	......	......	......	500	20	600	24	......	......	......	......
Groupers, fresh	......	......	......	......	......	......	......	......	......	......	10,000	250
Sheepshead, fresh	......	......	......	......	7,000	280	7,500	300	......	......	......	......
Snappers, red, fresh	......	......	......	......	......	......	......	......	......	......	6,000	150
Snappers, gray and others, fresh	......	......	......	......	2,000	80	2,200	88	......	......	......	......
Trout, fresh	......	......	......	......	800	32	1,000	40	......	......	......	......
Total	......	......	......	......	10,300	412	11,300	452	......	......	16,000	400
Miscellaneous:												
Sponges	......	......	......	......	......	......	......	......	900	900	800	800
Oysters	......	......	......	......	27,125	969	34,440	1,230	145,425	5,194	116,200	3,602
Quahogs	......	......	......	......	......	......	......	......	3,330	400	3,330	400
Terrapins	......	......	......	......	......	......	......	......	5,000	125	4,180	130
Turtles	......	......	......	......	......	......	......	......	70,705	4,596	89,958	6,297
Total	......	......	......	......	27,125	969	34,440	1,230	225,360	11,215	214,468	11,229
Grand total	208,900	2,329	198,900	2,321	231,491	4,884	197,328	4,377	1,809,041	32,488	1,742,418	31,593

C.—*Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1889 and 1890*—Continued.

Apparatus and species.	Lafayette.				Taylor.				Jefferson.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:												
Mullet, fresh	201,250	$4,750	275,000	$5,000	1,197,125	$12,200	825,500	$12,500			61,875	$800
Mullet, salted	76,750	2,700	87,500	3,000	287,250	6,000	236,250	6,250	21,875	$625	26,250	750
Mullet roe, salted	6,000	200	6,400	200								
Total	284,000	7,650	368,900	8,200	1,484,375	18,200	1,061,750	18,750	21,875	625	88,125	1,550

Apparatus and species.	Wakulla.				Franklin.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bluefish, fresh					800	$20	1,000	$25				
Channel bass, fresh	7,500	$150	7,000	$136	12,450	257	12,800	285				
Flounders, fresh	800	16	750	15								
Mullet, fresh	171,875	2,500	190,000	2,720	71,000	1,450	79,250	1,027				
Mullet, salted	79,750	2,223	98,875	2,000	93,000	3,225	224,850	4,544	96,000	$2,520	80,000	$2,100
Mullet roe, salted	7,500	405	9,250	463	14,800	915	43,250	2,561	18,000	1,260	16,000	1,120
Pompano, salted					1,500	52	1,800	63	6,500	163	3,000	82
Sheepshead, fresh	6,000	120	6,250	123	9,800	206	11,150	227				
Spanish mackerel, fresh					500	12	200	8				
Spanish mackerel, salted					1,000	25	1,200	42				
Trout, fresh	5,700	114	5,200	104	12,970	291	16,200	307				
Trout, salted									13,490	338	6,400	176
Miscellaneous fish, salted									5,000	125	3,100	85
Total	279,125	5,528	318,125	5,921	217,820	6,590	392,900	9,769	138,990	4,406	108,500	3,563
Gill nets:												
Black bass, fresh	4,200	86	5,000	100								
Bluefish, fresh	900	53	850	50	5,900	125	6,550	139				
Channel bass, fresh	8,500	170	10,500	210	13,900	295	14,700	312				
Mullet, fresh	1,160,500	16,880	1,065,025	15,500	164,250	3,000	233,000	4,060				
Mullet, salted	240,925	6,457	271,600	7,572	61,000	1,230	68,500	1,370				
Mullet roe, salted	4,800	240	5,150	258	4,400	228	5,850	311				
Pinfish, fresh	4,800	96	5,000	100								
Sea bass, fresh	3,200	64	3,500	70								
Sheepshead, fresh	7,750	155	8,670	174	12,630	268	14,350	305				
Spanish mackerel, fresh	600	36	500	30								
Trout, fresh	7,500	178	8,400	199	24,940	530	28,425	604				
Miscellaneous fish, salted	31,500	484	28,600	429								
Total	1,475,275	24,899	1,413,395	24,692	287,020	5,676	371,375	7,101				
Cast nets:												
Mullet, fresh					10,000	225	10,000	225	13,000	325	12,000	300
Lines:												
Bream, fresh					10,000	500	12,000	600				
Miscellaneous fish, fresh	5,200	156	6,000	180	17,000	850	16,000	800				
Total	5,200	156	6,000	180	27,000	1,350	28,000	1,400				
Miscellaneous:												
Sponges	990	990	640	640	1,975	3,160	1,405	2,316				
Oysters	17,815	640	18,095	653	933,086	22,832	1,372,182	33,301				
Total	18,805	1,630	18,735	1,293	935,061	25,992	1,373,587	35,617				
Grand total	1,778,405	32,213	1,756,255	32,086	1,476,901	39,833	2,175,862	54,112	151,990	4,731	120,500	3,863

22.—*Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1889 and 1890*—Continued.

Apparatus and species.	Washington.				Santa Rosa.				Escambia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Angel-fish, fresh									12,089	$174	39,265	$557
Bluefish, fresh	26,444	$510	17,241	$344	22,667	$437	14,777	$295	217,267	6,554	270,464	7,385
Bream and sunfish, fresh	2,079	21	2,275	23	1,783	17	1,950	19	10,660	168	20,663	312
Channel bass, fresh	3,136	42	2,584	35	2,688	36	2,216	30	23,137	422	38,395	822
Croakers, fresh									35,187	553	41,723	638
Flounders, fresh	110	3	50	2								
Lady-fish, fresh	4,929	49	4,847	48	4,225	42	4,156	42	85,155	852	82,011	880
Lady-fish, salted	22,800	681	22,000	660								
Jurel, fresh	21,425	214	29,866	299	18,363	184	25,599	256	74,929	999	204,090	2,301
Mullet, fresh	26,055	348	22,915	303	30,904	414	29,283	391	543,936	10,251	468,453	9,190
Mullet, salted	402,000	10,472	354,750	8,836								
Mullet roe, salted	65,900	4,288	68,400	3,938								
Pinfish, fresh									23,159	316	41,835	610
Pompano, fresh	4,016	597	5,086	521	3,443	512	4,360	446	76,860	15,550	59,286	12,887
Pompano, salted	27,000	690	16,500	473								
Sheepshead, fresh	5,257	106	5,126	109	4,507	90	4,394	81	52,452	1,573	39,443	1,342
Silver perch or yellow-tail, fresh									20,188	413	35,377	784
Spanish mackerel, fresh	14,056	427	22,239	697	12,049	366	19,064	542	205,728	8,930	223,281	8,919
Spanish mackerel, salted	8,800	241	5,000	138								
Spots, fresh									23,525	338	33,730	490
Trout, fresh	748	24	843	25	642	22	724	22	34,458	1,375	31,723	1,325
Trout, salted	66,450	1,637	33,750	890								
Whiting, fresh									14,934	361	25,242	521
Miscellaneous fish, fresh	12,815	126	11,466	121	10,120	110	9,833	105				
Miscellaneous fish, salted	36,800	964	18,900	520								
Total	750,820	21,443	643,838	17,982	111,391	2,230	116,356	2,229	1,453,664	48,824	1,654,981	48,963
Gill nets:												
Bluefish, fresh									1,854	59	4,615	216
Mullet, fresh									18,745	408	36,835	761
Mullet, salted	30,000	787	34,500	903								
Mullet roe, salted	5,500	385	6,400	448								
Spanish mackerel, fresh									1,094	73	3,625	236
Trout, fresh									1,279	46	4,091	233
Trout, salted	7,500	188	5,400	135								
Miscellaneous fish, salted	5,200	131	4,300	118								
Total	48,200	1,491	50,600	1,604					22,972	586	49,166	1,446
Cast nets:												
Mullet, fresh	20,000	500	18,000	450								
Lines:												
Groupers, fresh					2,263	22			24,720	247	17,530	175
Snappers, red, fresh					20,000	600			256,750	7,698	242,600	7,278
Total					22,263	622			281,470	7,945	260,130	7,453
Miscellaneous:												
Oysters	49,441	2,792	56,385	3,173					248,500	15,775	283,500	21,625
Turtles	100	2									400	20
Total	49,541	2,794	56,385	3,173					248,500	15,775	283,900	21,645
Grand total	868,561	26,228	768,823	23,209	133,654	2,852	116,356	2,229	2,006,606	73,130	2,248,177	79,507

22.—*Table showing by counties and apparatus the yield of the shore fisheries of the west coast of Florida in 1889 and 1890*—Continued.

SUMMARY.

Apparatus and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Seines:				
Angel-fish, fresh	25,433	$370	58,234	$844
Bluefish, fresh	279,506	7,742	336,980	8,427
Bream and sunfish, fresh	14,522	206	24,888	354
Channel bass, fresh	115,915	1,831	182,881	2,747
Crevalle, fresh	3,991	56	5,438	84
Croakers, fresh	35,187	553	41,723	638
Drum, fresh-water, fresh	12,347	174	14,304	210
Drum, salt-water, fresh	22,064	330	34,306	530
Flounders, fresh	6,292	91	7,874	116
Grunts, fresh	4,182	67	6,370	93
Lady-fish, fresh	98,989	1,458	96,014	1,530
Lady-fish, salted	22,800	684	22,000	660
Jurel, fresh	121,556	1,510	200,114	3,015
Mullet, fresh	1,557,800	20,108	2,182,275	25,087
Mullet, salted	1,691,435	56,942	1,729,091	47,733
Mullet roe, salted	306,184	13,152	235,047	12,279
Pinfish, fresh	23,159	316	41,835	610
Pompano, fresh	90,808	17,452	79,582	14,439
Pompano, salted	38,962	1,296	24,800	1,143
Sailor's-choice, fresh	6,904	131	12,805	191
Sheepshead, fresh	111,572	2,557	115,095	2,001
Silver perch or yellow-tail, fresh	29,188	413	35,377	784
Snappers, gray and others, fresh	7,878	103	9,337	134
Spanish mackerel, fresh	255,956	11,540	191,344	12,168
Spanish mackerel, salted	11,400	326	6,200	180
Spots, fresh	23,525	333	33,730	490
Trout, fresh	91,040	2,551	117,752	3,089
Trout, salted	79,940	1,975	40,15[illegible]	1,086
Whiting, fresh	14,934	361	25,242	521
Miscellaneous fish, fresh	22,935	236	21,280	226
Miscellaneous fish, salted	42,550	1,101	22,480	615
Total	5,065,504	145,965	6,094,237	143,574
Gill nets:				
Angel-fish, fresh	58,904	858	62,442	996
Black bass, fresh	4,300	86	5,000	100
Bluefish, fresh	69,780	1,274	79,388	1,639
Channel bass, fresh	264,881	3,836	277,851	4,063
Crevalle, fresh	13,380	190	12,586	303
Drum, fresh-water, fresh	36,627	510	38,580	561
Drum, salt-water, fresh	79,641	1,148	87,457	1,316
Flounders, fresh	13,837	185	15,746	220
Grunts, fresh	11,543	191	15,405	242
Jurel, fresh	27,147	450	27,726	471
Mullet, fresh	6,990,030	73,969	8,206,456	84,881
Mullet, salted	1,010,700	25,761	1,077,263	28,437
Mullet, smoked	1,500	65	1,200	48
Mullet roe, salted	35,096	1,898	43,212	2,619
Pinfish, fresh	8,800	146	9,500	156
Gill nets—continued.				
Pompano, fresh	109,584	18,073	155,750	18,600
Pompano, salted	14,300	710	6,300	415
Sailor's choice, fresh	48,461	702	44,672	653
Sea bass, fresh	5,300	124	5,700	136
Sheepshead, fresh	383,231	5,872	372,808	5,456
Snappers, gray and others, fresh	31,289	472	30,386	455
Spanish mackerel, fresh	46,083	3,110	58,625	4,008
Trout, fresh	307,138	7,615	392,836	7,589
Trout, salted	7,500	186	5,400	135
Miscellaneous fish, salted	40,950	703	36,420	617
Total	9,750,351	136,136	11,073,639	153,956
Cast nets and minor nets:				
Grunts, fresh	800	27	950	32
Mullet, fresh	92,375	2,236	87,938	2,183
Mullet, smoked	3,000	150	2,000	100
Snappers, gray and others, fresh	1,000	125	1,000	125
Miscellaneous fish, fresh	23,125	782	27,412	658
Total	120,300	3,300	118,300	3,298
Lines:				
Amber-fish, fresh	60,000	2,400	65,000	2,600
Angel-fish, fresh	3,450	173	4,000	200
Bream, fresh	10,000	500	12,000	600
Channel bass, fresh	5,250	256	11,590	348
Groupers, fresh	56,983	800	62,530	1,125
Grunts, fresh	585,830	20,731	656,000	21,835
Kingfish, fresh	456,253	16,747	281,725	12,625
Sheepshead, fresh	17,500	805	37,180	1,009
Snappers, red, fresh	376,750	13,296	288,600	8,436
Snappers, gray and others, fresh	6,200	227	6,700	253
Spanish mackerel, fresh	20,000	2,000	49,950	3,023
Trout, fresh	21,600	1,072	34,600	1,257
Miscellaneous fish, fresh	390,200	19,406	426,500	21,305
Total	2,019,494	77,486	1,830,315	75,298
Miscellaneous:				
Sponges	114,138	136,350	140,913	155,631
Oysters	1,826,447	64,535	2,390,217	84,030
Quahogs	6,000	547	6,000	547
Terrapins	5,000	125	4,180	130
Turtles	942,052	15,095	374,776	16,054
Turtle eggs	6,000	900	6,625	994
Tortoise shell	1,000	2,500	1,150	2,875
Total	2,900,637	206,652	2,913,861	280,251
Grand total	19,256,876	573,539	22,131,352	636,377

The shore industries.—The branches of the fishing industry which are prosecuted on shore by the citizens of Florida are of considerable importance and consist of the wholesale trade in fresh and salt fish, the wholesale oyster trade, the oyster-canning industry, the wholesale sponge trade, the wholesale trade in green turtles, and the wholesale alligator trade. The extent of these is shown in the following tables. To avoid the exhibition of private interests it has been necessary to present the figures in a condensed form for the entire state instead of by counties.

The trade in fresh and salt fish is carried on in Monroe, De Soto, Manatee, Hillsboro, Citrus, Levy, Franklin, and Escambia counties. The most extensive fresh-fish business is in Hillsboro and Escambia counties, at Tampa, St. Petersburg, and Pensacola. The salt-fish trade is most important in Franklin county, at Apalachicola, where about two-thirds of the salt fish are handled; there is also some trade in salt fish in Manatee, Hillsboro, Citrus, and Levy counties.

As shown in Table 23, the number of firms engaged in this business was 29 in 1889 and 31 in 1890. These had 127 employés the first year and 135 the next, exclusive of a small number of persons who gave more attention to other branches of the fishing industry and have been there included. The capital invested in the business amounted to over $235,000, and the annual wages paid to employés was about $35,000. The quantities of fresh and salt fish handled in 1890 aggregated 16,123,156 pounds, for which the dealers paid $312,237 and received $577,827, the gross profits being $265,590.

23.—Table showing the wholesale fish trade of the west coast of Florida in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	29	31
Number of persons employed	127	135
Value of property	$79,949	$89,139
Cash capital	$143,550	$146,650
Wages paid	$34,440	$34,650
Pounds of fresh fish handled	13,023,986	15,448,894
Value paid	$242,216	$294,772
Value received	$465,000	$551,815
Pounds of salt fish handled	628,000	674,262
Value paid	$16,607	$17,465
Value received	$23,622	$26,012
Enhancement in value	$229,799	$265,590

The oyster trade of the west coast of Florida is less extensive than that of any other Gulf State, but is nevertheless of considerable importance to the four counties (De Soto, Hillsboro, Levy, and Franklin) in which it is prosecuted. In Table 24 the most prominent features of the business are shown. Of the total number of firms, 3 in 1889 and 4 in 1890 were also engaged in other branches of the fishing industry. The number of persons actually employed in this trade was 32 in the first year and 42 in the second, but only those given in the table could be properly credited, as the others devoted more time and attention to other fishing business under which they have been included.

The oyster trade consists in the shipment of oysters in the shell and in the opening of oysters and the sale of the meats; the former business consumes more oysters, but the latter yields larger returns. In 1890, 83,466 bushels were handled, for which the dealers paid $20,370. The oysters sold in the shells and in an opened state yielded $47,609, so that the gross profits were $27,239.

24.—Table showing the extent of the wholesale oyster trade of Florida in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	8	10
Number of persons employed	17	19
Value of property	$9,695	$9,920
Cash capital	$7,000	$8,000
Wages paid	$3,980	$4,560
Oysters handled ... bushels	82,625	83,466
Value paid	$20,099	$20,370
Oysters sold in the shell ... bushels	43,632	39,620
Value	$18,625	$16,625
Oysters opened and sold ... gallons	29,380	33,650
Value	$27,588	$30,984
Enhancement in value	$26,114	$27,239

At present the business of canning oysters is confined to Franklin County, which had one cannery in 1889 and two canneries in 1890. In the latter year 200,826 bushels of oysters were consumed in the preparation of 997,008 one-pound and two-pound cans. The cost of the raw products was $38,471, and the market value of the canned goods was $86,768. Other features of this industry are brought out in Table 25.

25.—Table showing the extent of the oyster-canning industry of the west coast of Florida in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	1	2
Number of persons employed	91	122
Value of property	$7,150	$9,450
Cash capital	$15,000	$20,000
Wages paid	$6,886	$10,907
Oysters handled ... bushels	134,698	200,826
Value paid	$22,450	$38,471
Oysters canned:		
One-pound cans ... number	609,432	919,728
Two-pound cans ... do	52,872	77,280
Value as sold	$50,155	$86,768

The extent of the trade in green turtles is shown in Table 26. The business is carried on by five firms, in Monroe, De Soto, and Levy counties, the first and last each having two firms, only one of which devotes exclusive attention to the handling of turtles. The number of employés shown in the table represents only the persons who were connected with the firms having no other fishing business, and should be increased by five each year to cover those employed in two or more branches.

26.—Table showing the extent of the wholesale green-turtle trade of the west coast of Florida in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	5	5
Number of persons employed	3	3
Value of property	$400	$400
Cash capital	$3,750	$3,600
Wages paid	$350	$350
Green turtles handled ... pounds	252,644	263,471
Value paid	$14,479	$15,466
Value received	$21,886	$22,735
Enhancement in value	$7,407	$7,269

The sponge trade of Florida is one of the most important shore fishing industries. It is centered in Monroe, Wakulla, and Franklin counties, at Key West, St. Marks, and Apalachicola, and was carried on by 9 firms in 1889 and 10 in 1890, of which 6 and 7, respectively, were located in Key West. As will be seen from Table 27, 366,772 pounds of sponges were bought in 1890, for which $438,682 was paid. In the same year 408,873 pounds, with a cost value of $511,131, were sold, the price received being $650,668. In explanation of the fact that in 1890 more sponges were sold than were bought, it should be stated that the bulk of the sponges is bought during November and December and is not ready for shipment until the early part of the following year; the difference in the quantities purchased and sold therefore represents the sponges held over from the preceding season's stock. In 1889, 316,559 pounds of sponges were bought at a cost of $381,087, and there were sold 217,336 pounds, for which $272,835 was paid and $398,136 received. During this year the conditions were directly opposite to what they were in 1890, and, as has been shown, fewer sponges were sold than bought, the explanation being that a relatively small stock was carried over from the previous year and that a comparatively large part of the sponges bought in 1889 were held until the next year before being sold. The gross profits of the trade were $125,301 in 1889 and $139,537 in 1890.

During the last few years considerable quantities of Florida sponges have been exported to Europe, the value of the exports amounting to about $50,000 annually. Prior to 1888 only a few hundred dollars' worth of Florida sponges were shipped abroad annually, practically the entire export trade from New York being in the cheaper grades of sponges from the Bahama Islands.

27.—*Table showing the extent of the wholesale sponge trade of the west coast of Florida in 1889 and 1890.*

Designation.	1889.	1890.
Number of firms	9	10
Number of persons employed	62	66
Value of property	$43, 965	$49, 040
Cash capital	$249, 500	$257, 500
Wages paid	$35, 140	$39, 725
Sponges bought ... pounds	316, 559	366, 772
Value paid	$381, 087	$438, 682
Sponges sold ... pounds	217, 336	408, 873
Value paid	$272, 835	$511, 131
Value received	$398, 136	$650, 668
Enhancement in value	$125, 301	$139, 537

The trade in alligator hides is confined to Lee, De Soto, and Manatee counties, by far the largest business being done in Lee County. The table shows that in 1889 39,435 hides and in 1890 46,077 hides passed through the hands of the seven dealers. In addition to the hides there is also a considerable trade in alligator feet, which are brought in by the hunters and given in exchange for provisions and other supplies. In 1889, 70,286 feet, with a nominal value of $3,506, were handled, and in 1890, 84,110 feet, worth $4,205. Whatever pecuniary advantage accrues to the dealers simply represents the usual profits on the goods given in exchange. Otter skins incidentally taken by the alligator hunters are also handled by the dealers; the number received was 825 in 1889 and 775 in 1890, for which the fishermen were paid $1,912 and $1,787, respectively.

28.—*Table showing the extent of the wholesale alligator trade of the west coast of Florida in 1889 and 1890.*

Designation.	1889.	1890.
Number of firms	7	7
Number of persons employed	11	11
Value of property	$550	$550
Cash capital	$10,450	$10,350
Wages paid	$350	$350
Alligator hides handled ... number	39,435	46,077
Value paid	$30,103	$33,484
Value received	$35,924	$39,258
Enhancement in value	$5,821	$5,774

III.—FISHERIES OF ALABAMA.

Geography of the coast.—The coast line of Alabama is much shorter than that of any other State in the Gulf region, being only 180 miles long, made up chiefly of Mobile Bay, the only indentation of importance in the shore of the State. The Mobile River enters the head of the bay, and is a stream of considerable size, formed by two main branches, the Tombigbee and Alabama rivers. The shores are low, and for the most part sandy and marshy. A number of islands occur off the coast, especially at the mouth of Mobile Bay and in the western part of the State. Mississippi Sound, a large body of water extending the entire length of Mississippi, occupies that portion of Alabama west of Mobile Bay, the sound and bay being connected by Grant Pass. The only fishing settlements on this coast of sufficient size to warrant special mention are Mobile, at the head of Mobile Bay, and Bon Secours, on the bay of the same name, which is an eastward prolongation of the lower part of Mobile Bay.

General importance of the fisheries.—Alabama is interested in the fisheries to a less extent than any other Gulf State, although in proportion to the length of coast line the value of the products compares very favorably with the other States in this region. Alabama has undergone a satisfactory increase in the past decade in the essential elements of capital invested and value of products, the advance amounting to 254.16 per cent and 29.84 per cent, respectively. The increase is chiefly due to the development of the oyster industry, which is probably destined to attain much greater proportions, as the natural advantages of the State for oyster-culture will doubtless be more appreciated and receive greater attention in the near future. A large number of edible fishes occur in the waters of the State, the most important of which are mullet, trout, croakers, pompano, channel bass, snappers, and Spanish mackerel.

General statistics.—Four tables show in a condensed form the extent of the fisheries of Alabama in 1889 and 1890; these relate to the number of persons employed, the nationalities represented among the fishermen, the capital invested, and the products.

From Table 29 it will be seen that of the 618 persons engaged in the fishing industry in 1890, 93 were employed in vessel fisheries, 416 in shore or boat fisheries, and 109 in factories, fish-houses, etc.

The American nationality very largely predominates among the fishermen of this State, as shown in Table 30. In 1890 there were 540 citizens of the United States and 78 foreigners, chiefly Spanish. The foreign element is found chiefly in the shore fisheries, is only sparingly present in the vessel fisheries, and is entirely absent from the shore industries.

The capital invested in the fisheries of Alabama in 1890 was $135,290, of which $31,810 represented vessels and their outfits, $17,230 boats, $11,550 apparatus used in taking products, and $74,700 shore property and working capital. Seines are the most expensive means of capture, but tongs are the most numerous form.

The yield of the fisheries of Alabama in 1889 was 4,560,269 pounds, valued at $146,841, and in 1890 4,776,968 pounds, worth $154,871. Oysters are by far the most important product, $96,758 in 1889 and $107,812 in 1890 accruing from their sale. The most important species of fish taken are mullet and trout.

29.—Table of persons employed.

How engaged.	1889.	1890.
On vessels fishing	72	69
On vessels transporting	22	24
In shore fisheries	402	416
On shore, in fish-houses, etc	98	109
Total	594	618

30.—Table showing the nationality of persons engaged.

Nationalities.	Vessel fishermen.		Shore fishermen.		Shoresmen.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
American, white	86	86	321	335	45	48	452	469
American, colored	2	2	8	8	53	61	63	71
Spanish	1		32	32			33	32
Italian			6	6			6	6
Portuguese	1		9	9			10	9
Norwegian			2	2			2	2
Swedish	2	1					2	1
Malay			12	12			12	12
Others	2	4	12	12			14	16
Total	94	93	402	416	98	109	594	618

31:—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	27	$16, 600	26	$15, 700
Tonnage	283. 38		268. 47	
Outfit		5, 469		5, 545
Vessels transporting	11	7. 900	12	9, 000
Tonnage	101. 17		119. 40	
Outfit		1, 594		1, 565
Boats	205	14, 995	212	17, 230
Apparatus of capture—vessel fisheries:				
Seines	1	100		
Lines		50		50
Tongs	69	446	65	405
Apparatus of capture—shore fisheries:				
Seines	30	2, 765	30	2, 730
Trammel and gill nets	66	6, 620	66	6, 620
Cast nets	65	295	65	295
Set lines		52		52
Tongs	219	1. 314	233	1, 398
Shore property		28. 525		29, 100
Cash capital		40, 200		45, 600
Total		126, 925		135, 290

32.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Angel-fish	6,525	$65	5,168	$52
Bluefish	57,612	1,242	55,760	1,213
Bream and sunfish	21,800	1,090	19,200	960
Catfish	37,700	945	37,600	940
Channel bass	63,919	2,658	54,464	2,242
Crevalle	13,100	458	10,000	351
Croakers	103,025	3,445	98,075	3,231
Drum, salt-water	7,400	222	7,000	210
Flounders	19,800	1,188	19,800	1,188
Groupers	9,750	195	11,250	225
Jurel	30,875	480	31,285	473
Lady-fish	12,850	129	12,920	129
Mullet	613,315	13,622	587,555	13,097
Pickerel	37,500	1,125	34,500	1,035
Pinfish	18,650	406	15,416	375
Pompano	17,825	2,674	17,178	2,577
Sailor's choice	3,600	126	2,800	98
Sheepshead	32,925	1,322	35,114	1,314
Silver perch	4,283	65	4,845	73
Snappers, red	51,000	2,040	62,375	2,495
Spanish mackerel	57,791	3,414	43,966	2,464
Spots	25,325	639	25,450	606
Trout	204,841	10,740	208,750	10,706
Whiting	4,283	64	4,307	65
Terrapins	5,600	1,120	4,700	940
Shrimp	30,000	600		
Oysters	*3,068,975	96,758	†3,367,490	107,812
Total	4,560,269	146,841	4,776,908	154,871

* 438,425 bushels.

† 481,070 bushels.

The fisheries by counties.—The coast of Alabama is occupied by the counties of Baldwin and Mobile, each of which has fishery interests of commercial importance; they are separated by Mobile Bay. The city of Mobile is in the county of the same name, and gives to it the lead which its fisheries take over those of Baldwin County.

Tables 33, 34, and 35, which follow, show the extent of the fisheries in these counties; they should be read in connection with other tables under the heads of "Fisheries by apparatus" and "The vessel and shore fisheries," in which additional figures for the counties are given.

33.—Table showing by counties the number of persons employed in the fisheries of Alabama in 1889 and 1890.

How engaged.	Baldwin.		Mobile.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.
On vessels fishing	47	44	25	25	72	69
On vessels transporting	2	4	20	20	22	24
In shore fisheries	165	173	237	243	402	416
On shore, in fish-houses, etc			98	109	98	109
Total	214	221	380	397	594	618

34.—Table showing by counties the apparatus and capital employed in the fisheries of Alabama in 1889 and 1890.

Designation.	Baldwin.				Mobile.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	18	$11,500	17	$10,700	9	$5,100	9	$5,000	27	$16,600	26	$15,700
Tonnage	176.44		165.02		106.94		103.45		283.38		268.47	
Outfit		3,427		3,329		2,042		2,216		5,469		5,545
Vessels transporting	1	800	2	1,600	10	7,100	10	7,400	11	7,900	12	9,000
Tonnage	8.53		19.38		100.67		100.02				119.40	
Outfit		244		400		1,350		1,165		1,594		1,565
Boats	80	7,040	84	8,100	125	7,995	128	9,130	205	14,995	212	17,230
Apparatus of capture—vessel fisheries:												
Seines	1	100							1	100		
Lines						50		50		50		50
Tongs	47	298	44	271	22	148	21	134	69	446	65	405
Apparatus of capture—shore fisheries:												
Seines	19	1,865	19	1,830	11	900	11	900	30	2,765	30	2,730
Trammel and gill nets	42	4,220	42	4,220	24	2,400	24	2,400	66	6,620	66	6,620
Cast nets	35	175	35	175	30	120	30	120	65	295	65	295
Set lines		52		52						52		52
Tongs	30	180	38	228	189	1,134	195	1,170	219	1,314	233	1,398
Shore property		225		225		28,300		28,875		28,525		29,100
Cash capital						40,200		45,600		40,200		45,600
Total		30,126		31,130		96,799		104,160		126,925		135,290

35.—Table showing by counties and species the yield of the fisheries of Alabama in 1889 and 1890.

Species.	Baldwin.				Mobile.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish	6,525	$65	5,168	$52					6,525	$65	5,168	$52
Bluefish	57,612	1,242	55,760	1,213					57,612	1,242	55,760	1,213
Bream and sunfish	5,800	290	5,000	250	16,000	$800	14,200	$710	21,800	1,090	19,200	960
Catfish	26,300	660	27,000	675	11,400	285	10,600	265	37,700	945	37,600	940
Channel bass	35,519	1,310	32,364	1,137	28,400	1,348	22,100	1,105	63,919	2,658	54,464	2,242
Crevalle	9,700	339	7,500	263	3,400	119	2,500	88	13,100	458	10,000	351
Croakers	86,425	2,864	82,575	2,688	16,600	581	15,500	543	103,025	3,445	98,075	3,231
Drum, salt-water	7,400	222	7,000	210					7,400	222	7,000	210
Flounders	18,400	1,104	18,600	1,116	1,400	84	1,200	72	19,800	1,188	19,800	1,188
Groupers					9,750	195	11,250	225	9,750	195	11,250	225
Jurel	30,875	489	31,285	473					30,875	489	31,285	473
Lady-fish	12,850	129	12,920	129					12,850	129	12,920	129
Mullet	428,715	9,006	409,955	8,657	184,600	4,616	177,600	4,440	613,315	13,622	587,555	13,097
Pickerel	37,500	1,125	34,500	1,035					37,500	1,125	34,500	1,035
Pinfish	18,650	406	15,416	375					18,650	406	15,416	375
Pompano	15,325	2,299	15,378	2,307	2,500	375	1,800	270	17,825	2,674	17,178	2,577
Sailor's choice	3,600	126	2,800	98					3,600	126	2,800	98
Sheepshead	16,025	561	20,114	639	16,900	761	15,000	675	32,925	1,322	35,114	1,314
Silver perch	4,283	65	4,845	73					4,283	65	4,845	73
Snappers, red					51,000	2,040	62,375	2,495	51,000	2,040	62,375	2,495
Spanish mackerel	49,391	2,154	36,466	1,339	8,400	1,260	7,500	1,125	57,791	3,414	43,966	2,464
Spots	21,825	534	22,250	510	3,500	105	3,200	96	25,325	639	25,450	606
Trout	138,341	7,220	146,750	7,498	66,500	3,520	62,000	3,208	204,841	10,740	208,750	10,706
Whiting	4,283	64	4,307	65					4,283	64	4,307	65
Shrimp	30,000	600							30,000	600		
Terrapins					5,600	1,120	4,700	940	5,600	1,120	4,700	940
Oysters	460,250	21,043	602,574	26,795	2,608,725	75,715	2,764,916	81,017	3,068,975	96,758	3,367,490	107,812
Total	1,525,594	53,917	1,600,527	57,597	3,034,675	92,924	3,176,441	97,274	4,560,269	146,841	4,776,968	154,871

The vessel and shore fisheries.—Under the head of "Fisheries by counties," the persons and capital employed in the vessel and shore fisheries have been shown. In this place it only remains to consider the quantity and value of products accruing from each branch. The following tables show that in 1890 the vessel fisheries yielded [illegible] pounds of products, valued at $[illegible], and the shore fisheries [illegible] pounds, worth $[illegible]. The vessel fisheries are chiefly for oysters, and are much more important in Baldwin County than in Mobile County. In the shore fisheries, in which the proportion of fish to oysters is much greater than in the vessel fisheries, the yield is larger in Mobile County.

Table showing by counties the yield of the vessel fisheries of Alabama in 1889 and 1890.

Species.	Baldwin. 1889. Pounds.	Baldwin. 1889. Value.	Baldwin. 1890. Pounds.	Baldwin. 1890. Value.	Mobile. 1889. Pounds.	Mobile. 1889. Value.	Mobile. 1890. Pounds.	Mobile. 1890. Value.	Total. 1889. Pounds.	Total. 1889. Value.	Total. 1890. Pounds.	Total. 1890. Value.
Red snapper					[illegible]	115	[illegible]	[illegible]	[illegible]	115	[illegible]	[illegible]
[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Shrimp	[illegible]	[illegible]							[illegible]	[illegible]		
Oysters	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table showing by counties and species the yield of the shore fisheries of Alabama in 1889 and 1890.

Species.	Baldwin. 1889. Pounds.	Baldwin. 1889. Value.	Baldwin. 1890. Pounds.	Baldwin. 1890. Value.	Mobile. 1889. Pounds.	Mobile. 1889. Value.	Mobile. 1890. Pounds.	Mobile. 1890. Value.	Total. 1889. Pounds.	Total. 1889. Value.	Total. 1890. Pounds.	Total. 1890. Value.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
Mullet	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oysters	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Fisheries by apparatus.—A table is next presented which shows, by counties, the quantities and values of products taken with the various kinds of apparatus employed in the shore fisheries of the State. In the vessel fisheries only lines are used in the capture of fish, and tongs are the only other form of apparatus in use, although in 1889 one seine was employed in catching shrimp. The largest quantities of fish are taken with seines; in 1890 the catch amounted to 767,353 pounds, valued at $23,650. Gill nets and trammel nets in the same year took 508,300 pounds, worth $18,362. The yield of cast nets is very small, being only 40,500 pounds in 1890, for which the fishermen received $1,012. Lines, which are somewhat important in the vessel fishery, took only 15,000 pounds of catfish in the shore fishery. Besides fish proper, seines and gill nets took 4,700 pounds of terrapins, valued at $940, the catch being nearly equally divided between the two kinds of apparatus.

38.—Table showing by counties and apparatus the yield of the shore fisheries of Alabama in 1889 and 1890.

Apparatus and species.	Baldwin.				Mobile.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Angel-fish	6,525	$65	5,168	$52					6,525	$65	5,168	$52
Bluefish	57,612	1,242	55,760	1,213					57,612	1,242	55,760	1,213
Bream and sunfish	2,300	115	1.000	50	6,500	$325	5,700	$285	8,800	440	6,700	335
Catfish	3,800	95	2,000	50	11,400	285	10,600	265	15,200	380	12,600	315
Channel bass	29,319	1,040	26,864	892	15,800	718	11,600	580	45,119	1,758	38,464	1,472
Crevalle	6,200	217	5,000	175	3,400	119	2,500	88	9,600	336	7,500	263
Croakers	81,425	2,689	77,075	2,496	16,600	581	15,500	543	98,025	3,270	92,575	3,039
Drum, salt-water	3,400	102	2,500	75					3,400	102	2,500	75
Flounders	15,900	954	14,600	876	1,400	84	1,200	72	17,300	1,038	15,800	948
Jurel	30,875	489	31,285	473					30,875	489	31,285	473
Lady-fish	12,850	129	12,920	129					12,850	129	12,920	129
Mullet	241,715	4,331	219,455	3,895	65,700	1,643	62,400	1,560	307,415	5,974	281,855	5,455
Pickerel	2,500	75	1,500	45					2,500	75	1,500	45
Pinfish	16,150	281	12,416	325					16,150	281	12,416	325
Pompano	12,825	1,924	13,378	2,007	2,500	375	1,800	270	15,325	2,299	15,178	2,277
Sailor's choice	3,600	126	2,800	98					3,600	126	2,800	98
Sheepshead	14,025	471	17,614	527	10,500	473	9,400	423	24,525	944	27,014	950
Silver perch	4,283	65	4,845	73					4,283	65	4.845	73
Spanish mackerel	49,391	2,154	36,466	1,339	8,400	1,260	7,500	1,125	57,791	3,414	43,966	2,464
Spots	19,625	468	20,250	450	3,500	105	3,200	96	23,125	573	23,450	546
Trout	33,341	1,820	30,750	1,618	38,500	1,540	38,000	1,520	71,841	3,360	68,750	3,138
Whiting	4,283	64	4,307	65					4,283	64	4,307	65
Total	651,944	18,916	597,953	16,823	184,200	7,508	169,400	6,827	836,144	26,424	767,353	23,650
Trammel nets and gill nets:												
Bream and sunfish	3,500	175	4,000	200	9,500	475	8,500	425	13,000	650	12,500	625
Catfish	8,500	215	10,000	250					8,500	215	10,000	250
Channel bass	6,200	270	5,500	245	12,600	630	10,500	525	18,800	900	16,000	770
Crevalle	3,500	122	2,500	88					3,500	122	2,500	88
Croakers	5,000	175	5,500	192					5,000	175	5,500	192
Drum, salt-water	4,000	120	4,500	135					4,000	120	4,500	135
Flounders	2,500	150	4,000	240					2,500	150	4,000	240
Mullet	175,000	4,375	180,000	4,500	87,400	2,185	85,200	2,130	262,400	6,560	265,200	6,630
Pickerel	35,000	1,050	33,000	990					35,000	1,050	33,000	990
Pinfish	2,500	125	3,000	150					2,500	125	3,000	150
Pompano	2,500	375	2,000	300					2,500	375	2,000	300
Sheepshead	2.000	90	2,500	112	6,400	288	5,600	252	8,400	378	8,100	364
Spots	2,200	66	2,000	60					2,200	66	2,000	60
Trout	105,000	5,400	116,000	5,880	28,000	1,980	24,000	1,688	133,000	7,380	140,000	7,568
Total	357,400	12,708	374,500	13,342	143,900	5,558	133,800	5,020	501,300	18,266	508,300	18,362
Cast nets:												
Mullet	12,000	300	10,500	262	31,500	788	30,000	750	43,500	1,088	40,500	1,012
Lines:												
Catfish	14,000	350	15,000	375					14,000	350	15,000	375
Miscellaneous:												
Terrapins					5,600	1,120	4,700	940	5,600	1,120	4,700	940
Oysters	117,166	5,023	189,259	7,921	2,367,750	68,797	2.506,791	73,513	2,484,916	73,820	2,696,050	81,434
Total	117,166	5,023	189,259	7,921	2,373,350	69,917	2,511,491	74,453	2,490,516	74,940	2,700,750	82,374
Grand total	1,152,500	37,297	1,187,212	38,723	2,732,950	83,771	2,844,691	87,050	3,885,460	121,068	4,031,903	125,773

The shore industries.—Two shore branches of the fishing business occupy the attention of the people of Alabama: these are the wholesale trades in oysters and fish, which are carried on at Mobile.

The wholesale oyster trade consists of several branches: the shipment of oysters in the shell; the shucking of oysters for shipment in ice in buckets, half-barrels, barrels, etc., and the packing of shucked oysters in hermetically sealed buckets, holding from 1 to 4 quarts. As shown in Table 39, eight firms were engaged in the oyster trade in 1889 and 1890. These handled 78,076 barrels of shell oysters in 1890, for which $80,292 was paid; the shell and opened oysters sold for $132,627, giving $52,335 as the gross profits of the industry. Other details of the business are brought out in Table 39.

The fish trade was engaged in by four firms in 1889 and 1890. In the latter year 2,348,270 pounds of fish were purchased, at a cost of $123,838; these were sold for $165,503, so that the gross profits of the business were $41,665. Other features of this branch are shown in Table 40. Some firms devote attention to both oysters and fish, and in the separation of these two trades in the tables it has been necessary to make an arbitrary division of persons and property. The tables should therefore be considered conjointly.

39.—*Table showing the wholesale oyster trade of Alabama in 1889 and 1890.*

Designation.	1889.	1890.
Number of firms	8	8
Number of employes	85	85
Value of property	$19,000	$30,650
Cash capital	$19,200	$23,100
Wages paid to shuckers and others	$24,969	$26,454
Oysters handled:		
"Reefers" . . . bbls.	50,797	58,835
Value paid	$44,178	$50,001
"Cullings" . . . bbls.	7,815	9,113
Value paid	$6,567	$10,015
"Plants" . . . bbls.	6,655	10,128
Value paid	$17,110	$20,276
Total . . . bbls.	65,267	78,076
Value paid	$67,855	$80,292
Value of products as sold	$136,980	$132,627
Enhancement in value	$67,675	$52,335

40.—*Table showing the wholesale fish trade of Alabama in 1889 and 1890.*

Designation.	1889.	1890.
Number of firms	4	4
Number of employes	13	14
Value of property	$6,725	$6,850
Cash capital	$21,000	$22,300
Wages paid	$5,904	$4,667
Fish handled . . . pounds	2,039,329	2,348,270
Value paid	$106,257	$123,838
Value paid	$146,156	$165,503
Enhancement in value	$39,899	$41,665

IV.—FISHERIES OF MISSISSIPPI.

Geographical features of the coast.—Mississippi is the middle member of the tier of five States having frontage on the Gulf of Mexico. Its coast line, which is about 215 miles in length, is shorter than any of the other States except Alabama. The shores are low throughout, sandy in places, but generally marshy, and are broken by a number of small indentations, the most important of which are Point Aux Chenes Bay, Pascagoula Bay, Biloxi Bay, and St. Louis Bay. Each of these receives the water of a large number of minor streams. At a distance of about 10 miles the shore is skirted by a line of small, mostly low, islands, which have an important bearing on the fisheries of the region. Between the islands and the mainland is Mississippi Sound, which extends the entire length of the State, terminating on the west in Lake Borgne, Louisiana, and on the east at the mouth of Mobile Bay, Alabama. It is noted for its oyster beds and is the fishing-ground chiefly frequented by the Mississippi fishermen.

The settlements on the coast are Pascagoula, Scranton, Ocean Springs, Biloxi, Beauvoir, Mississippi City, Pass Christian, and Bay St. Louis, all of which are more or less interested in the fisheries.

General importance of the fisheries.—Taking the value of the fishery products as a basis, Mississippi ranks third among the Gulf States, being surpassed by Florida and Louisiana. In 1880 it occupied the fifth position. The State has had a phenomenal increase in its fishery interests since 1880, and no other State in this region or in the country has advanced in greater relative ratio. As shown in Section I of this report, the number of persons engaged in the fishing industry has increased 825.27 per cent; the capital devoted to the business has increased 4,839.89 per cent, and the value of the products has increased 990.06 per cent. The fishery resources of the State, especially the waters for oyster-culture, are still capable of much development, and the history of the past decade indicates that in a short time Mississippi will beco
one of the foremost oyster-producing States.

General statistics.—The extent of the commercial fisheries of Mississippi i
and 1890 is shown in the following tables.

Table 41 shows 1,809 persons employed in the fisheries in 1889 and 1,72
of whom more than half each year were employed on shore, in cannerie
houses, etc. The vessel fisheries are seen to have required the servic
fewer men than the shore or boat fisheries.

The nationality of the persons employed in the fisheries of the S
American, as shown in Table 42, only 78 persons in 1890 being aliens,
cans, about one-fifth are colored people, who are chiefly employ
largest number of foreigners obtain employment on the vessels
in the shore industries.

The capital invested in the fisheries of this State, as
$455,300 in 1889 and $434,710 in 1890. The investment is
property and cash capital employed in the canning and oth
two vessels engaged in the fisheries in 1890; these, with

$48,759. The number of boats in use was 257, worth $13,395. The apparatus of capture consisted of seines, tongs, gill nets, trammel nets, cast nets, and lines, and was valued at $10,485.

The yield of the fisheries in 1889 was 8,933,339 pounds and in 1890 8,131,401 pounds, valued at $250,884 and $245,699, respectively. Oysters are by far the most important product, constituting two-thirds the quantity and value of the entire output of the State. Of the fish proper, the sea trout or squeteague is the most valuable, although the mullet is taken in larger numbers. Next to the trout, the value of shrimps is greater than any other single species.

41.—Table of persons employed.

How engaged.	Number.	
	1889.	1890.
In vessel fisheries	191	203
In shore fisheries	553	487
On shore, in fish-houses, etc	1,065	1,031
Total	1,809	1,721

42.—Table showing the nationality of persons employed.

Nationalities.	In vessel fisheries.		In shore fisheries.		On shore, in fish-houses, etc.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
American, white	166	170	474	402	776	765	1,416	1,337
American, colored	1		43	40	289	266	333	306
Spanish			27	28			27	28
Portuguese	8	6	3	6			11	12
French	4	4	1	1			5	5
Norwegian	5	4	5	5			10	9
Swedish	1	3		5			1	8
Austrian	5	5					5	5
Others	1	11						11
Total	191	203	553	487	1,065	1,031	1,809	1,721

43.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	59	$34,525	61	$34,950
Tonnage	541.52		557.46	
Outfit		11,658		12,334
Vessels transporting			1	1,450
Tonnage			12.56	
Outfit				25
Boats	275	14,685	257	13,395
Apparatus of capture—vessel fisheries:				
Seines	33	2,255	33	2,350
Tongs	192	1,407	201	1,462
Apparatus of capture—shore fisheries:				
Seines	59	5,070	47	4,330
Trammel and gill nets	32	1,160	15	555
Cast nets	41	263	8	48
Lines		3		3
Tongs	323	2,003	278	1,737
Shore property		119,821		110,771
Cash capital		262,450		251,300
Total		455,300		434,710

44.—Table of products

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Angel-fish	23, 500	$774	29. 350	$1, 019
Black bass	5, 200	260	6, 000	300
Bluefish	90, 300	4, 515	95, 900	4, 595
Bream and sunfish	85, 200	3, 522	89, 100	3, 609
Buffalo-fish	107, 600	1, 076	121, 700	1, 217
Catfish	88, 450	1, 687	93, 400	1, 794
Channel bass	184, 700	8, 277	201, 300	8, 757
Croakers	53, 950	1, 353	57, 325	1, 465
Drum, salt-water	2, 500	125	3, 200	160
Flounders	70, 100	2, 754	76, 550	3, 097
Mullet	721, 593	7, 000	305, 400	3, 479
Pickerel	12, 300	492	14, 750	590
Pinfish	54, 700	1, 585	55, 200	1, 593
Pompano	14, 025	1, 544	14, 875	1, 637
Sea bass	24, 500	1, 151	23, 660	1, 065
Sheepshead	155, 700	6, 897	173, 200	7, 870
Spanish mackerel	43, 575	2, 956	46, 500	3, 150
Spots	45, 075	1, 352	45, 885	1, 375
Trout	370, 450	17, 163	372, 100	17, 596
Crabs, hard	48, 000	1, 307	32, 560	1, 307
Crabs, soft	19, 200	640	14, 600	730
Shrimp	794, 200	16, 741	613, 500	12, 622
Oysters	*5, 918, 521	167, 713	†5, 645, 346	166, 672
Total	8, 933, 339	250, 884	8, 131, 401	245, 699

* 845,503 bushels.

† 806,478 bushels.

The fisheries by counties.—Three counties occupy the shore line of Mississippi, each of which is interested in the prosecution of commercial fisheries; these are Jackson, Harrison, and Hancock. In Tables 45, 46, and 47, the extent of the fisheries in each of these counties is shown in detail. In other tables which follow, under the captions "The vessel and shore fisheries" and "Fisheries by apparatus," figures giving additional phases of the fisheries in each county are presented.

In Harrison County, in which the important fishing centers, Biloxi and Mississippi City, are located, the fisheries are much more extensive than elsewhere in the State. The tables show that about two-thirds of the persons engaged, three-fourths of the capital invested, and one-half of the value of products taken are to be credited t Harrison County.

45.—Table showing by counties the number of persons employed in the fisheries of Mississippi 1889 and 1890.

How engaged.	Jackson.		Harrison.		Hancock.		Tot
	1889.	1890.	1889.	1890.	1889.	1890.	1889.
In vessel fisheries	30	30	147	158	14	15	
In shore fisheries	128	132	323	257	102	98	
On shore, in factories, fish-houses, etc	74	81	924	883	67	67	
Total	232	243	1, 394	1, 298	183	180	

$48,759. The number of boats in use was 257, worth $13,395. The apparatus of capture consisted of seines, tongs, gill nets, trammel nets, cast nets, and lines, and was valued at $10,485.

The yield of the fisheries in 1889 was 8,933,339 pounds and in 1890 8,131,401 pounds, valued at $250,884 and $245,699, respectively. Oysters are by far the most important product, constituting two-thirds the quantity and value of the entire output of the State. Of the fish proper, the sea trout or squeteague is the most valuable, although the mullet is taken in larger numbers. Next to the trout, the value of shrimps is greater than any other single species.

41.—Table of persons employed.

How engaged.	Number.	
	1889.	1890.
In vessel fisheries	191	203
In shore fisheries	553	487
On shore, in fish-houses, etc	1,065	1,031
Total	1,809	1,721

42.—Table showing the nationality of persons employed.

Nationalities.	In vessel fisheries.		In shore fisheries.		On shore, in fish-houses, etc.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
American, white	166	170	474	402	776	765	1,416	1,337
American, colored	1		43	40	289	266	333	306
Spanish			27	28			27	28
Portuguese	8	6	3	6			11	12
French	4	4	1	1			5	5
Norwegian	5	4	5	5			10	9
Swedish	1	3		5			1	8
Austrian	5	5					5	5
Others	1	11						11
Total	191	203	553	487	1,065	1,031	1,809	1,721

43.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	50	$34,525	61	$34,950
Tonnage	541.52		357.46	
Outfit		11,658		12,334
Vessels transporting			1	1,450
Tonnage			12.36	
Outfit				25
Boats	275	14,685	257	13,395
Apparatus of capture—vessel fisheries:				
Seines	33	2,255	33	2,350
Tongs	192	1,007	201	1,462
Apparatus of capture—shore fisheries:				
Seines	50	3,670	47	4,330
Trammel and gill nets	32	1,190	15	555
Cast nets	41	283	8	48
Lines		3		3
Tongs	323	2,008	278	1,737
Shore property		118,821		110,771
Cash capital		262,450		251,300
Total		455,300		434,710

44.—Table of products

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Angel-fish	23, 500	$774	29, 350	$1, 019
Black bass	5, 200	260	6, 000	300
Bluefish	90, 300	4, 515	95, 900	4, 595
Bream and sunfish	85, 200	3, 522	89, 100	3, 609
Buffalo-fish	107, 600	1, 076	121, 700	1, 217
Catfish	88, 450	1, 687	93, 400	1, 794
Channel bass	184, 700	8, 277	201, 300	8, 757
Croakers	53, 950	1, 353	57, 325	1, 465
Drum, salt-water	2, 500	125	3, 200	160
Flounders	70, 100	2, 754	76, 550	3, 097
Mullet	721, 593	7, 000	305, 400	3, 479
Pickerel	12, 300	492	14, 750	590
Pinfish	54, 700	1, 585	55, 200	1, 593
Pompano	14, 025	1, 544	14, 875	1, 637
Sea bass	24, 500	1, 151	23, 660	1, 065
Sheepshead	155, 700	6, 897	173, 200	7, 870
Spanish mackerel	43, 575	2, 956	46, 500	3, 150
Spots	45, 075	1, 352	45, 885	1, 375
Trout	370, 450	17, 163	372, 100	17, 596
Crabs, hard	48, 000	1, 307	32, 560	1, 307
Crabs, soft	19, 200	640	14, 600	730
Shrimp	794, 200	16, 741	613, 500	12, 622
Oysters	*5, 918, 521	167, 713	†5, 645, 346	166, 672
Total	8, 933, 339	250, 884	8, 131, 401	245, 699

* 845,503 bushels. † 806,478 bushels.

The fisheries by counties.—Three counties occupy the shore line of Mississippi, each of which is interested in the prosecution of commercial fisheries; these are Jackson, Harrison, and Hancock. In Tables 45, 46, and 47, the extent of the fisheries in each of these counties is shown in detail. In other tables which follow, under the captions "The vessel and shore fisheries" and "Fisheries by apparatus," figures giving additional phases of the fisheries in each county are presented.

In Harrison County, in which the important fishing centers, Biloxi and Mississippi City, are located, the fisheries are much more extensive than elsewhere in the State. The tables show that about two-thirds of the persons engaged, three-fourths of the capital invested, and one-half of the value of products taken are to be credited to Harrison County.

45.—Table showing by counties the number of persons employed in the fisheries of Mississippi in 1889 and 1890.

How engaged.	Jackson.		Harrison.		Hancock.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
In vessel fisheries	30	30	147	158	14	15	191	203
In shore fisheries	128	132	323	257	102	98	553	487
On shore, in factories, fish-houses, etc	74	81	924	883	67	67	1, 065	1, 031
Total	232	243	1, 394	1, 298	183	180	1, 809	1, 721

46.—Table showing by counties the number and value of vessels, boats, apparatus, etc., employed in the fisheries of Mississippi in 1889 and 1890.

Designation.	Jackson.				Harrison.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	8	$4,950	8	$4,900	47	$28,225	48	$27,500
Tonnage	88.17	....	88.17	....	413.40	....	415.78	....
Outfit	....	1,782	....	1,500	....	8,966	....	9,850
Vessels transporting only	....	....	....	....	....	....	1	1,450
Tonnage	....	....	....	....	....	....	12.56	....
Outfit	....	....	....	....	....	....	....	25
Boats	54	3,140	56	3,250	176	7,995	158	6,945
Apparatus of capture—vessel fisheries:								
Seines	5	260	5	250	27	1,960	27	2,050
Tongs	30	223	30	230	147	1,069	153	1,096
Apparatus of capture—shore fisheries:								
Seines	11	990	11	925	42	3,480	30	2,805
Trammel nets and gill nets	3	210	3	200	29	950	12	355
Cast nets	....	....	....	....	41	263	8	48
Lines	....	....	....	....	....	3	....	3
Tongs	81	525	82	522	164	1,010	122	770
Shore property	....	10,425	....	12,450	....	96,396	....	85,271
Cash capital	....	15,500	....	17,200	....	219,100	....	206,150
Total	....	38,005	....	41,427	....	369,417	....	344,318

Designation.	Hancock.				Total.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	4	$1,350	5	$2,550	59	$34,525	61	$34,950
Tonnage	39.95	....	53.51	....	544.52	....	557.46	....
Outfit	....	910	....	984	....	11,658	....	12,334
Vessels transporting only	....	....	....	....	....	....	1	1,450
Tonnage	....	....	....	....	....	....	12.56	....
Outfit	....	....	....	....	....	....	....	25
Boats	45	3,550	43	3,200	275	14,685	257	13,395
Apparatus of capture—vessel fisheries:								
Seines	1	35	1	50	33	2,255	33	2,350
Tongs	15	115	18	136	192	1,407	201	1,462
Apparatus of capture—shore fisheries:								
Seines	6	600	6	600	59	5,070	47	4,330
Trammel nets and gill nets	....	....	....	....	32	1,160	15	555
Cast nets	....	....	....	....	41	263	8	48
Lines	....	....	....	....	....	3	....	3
Tongs	78	468	74	445	323	2,003	278	1,737
Shore property	....	13,000	....	13,050	....	119,821	....	110,771
Cash capital	....	27,850	....	27,950	....	262,450	....	251,300
Total	....	47,878	....	48,965	....	455,300	....	434,710

47.—Table showing by counties the yield of the fisheries of Mississippi in 1889 and 1890.

Species.	Jackson.				Harrison.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish	15, 900	$318	18, 550	$371	7, 600	$456	10, 800	$648
Black bass	....	....	....	....	5, 200	260	6, 000	300
Bluefish	45, 100	2, 255	49, 700	2, 485	23, 200	1, 160	25, 000	1, 250
Bream and sunfish	44, 300	1, 844	49, 600	1, 984	17. 700	750	17, 000	725
Buffalo-fish	107, 600	1, 076	121, 700	1, 217	....	....	....	....
Catfish	40, 950	737	46, 300	852	23, 000	460	22, 000	440
Channel bass	75, 300	3, 012	78, 400	2, 736	66, 400	3, 543	79, 000	4, 265
Croakers	42, 650	853	44, 025	880	11, 300	500	13, 300	585
Drum, salt-water	....	....	....	....	2, 500	125	3, 200	160
Flounders	28, 400	1, 056	32, 750	1, 310	20, 200	838	20, 000	835
Mullet	133, 300	1, 333	140, 200	1, 402	525, 093	5, 035	97, 500	1, 400
Pickerel	12. 300	492	14, 750	590	....	....	....	....
Pinfish	14, 400	369	15, 800	400	28, 500	862	28, 600	869
Pompano	4, 700	465	4, 775	477	3, 175	464	3, 500	500
Sea bass	5, 800	410	5, 660	441	5, 500	275	4, 200	210
Sheepshead	68, 700	2, 748	69. 900	2, 796	63, 500	3, 209	74, 400	3, 918
Spanish mackerel	13, 975	840	15, 600	876	15, 000	1, 240	15, 800	1, 368
Spots	17, 575	527	19, 985	598	13, 400	402	12, 500	375
Trout	245, 950	10, 363	246, 500	10, 666	90. 500	5, 100	91, 200	5, 210
Crabs, hard	4, 800	120	3, 200	120	36, 300	1, 014	23, 460	966
Crabs, soft	5, 400	180	3, 200	160	1. 800	60	1, 600	80
Shrimp	185, 400	3, 704	196, 900	3, 792	563, 300	12, 179	375, 000	8, 000
Oysters	1, 076, 754	34, 435	1, 168, 202	39, 123	3, 845, 674	106, 495	3, 351, 516	97, 278
Total	2, 189, 254	67, 137	2, 345, 697	73, 276	5, 368, 842	144, 427	4. 275, 576	129, 382

Species.	Hancock.				Total.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish	....	....	....	....	23, 500	$774	29, 350	$1, 019
Black bass	....	....	....	....	5, 200	260	6, 000	300
Bluefish	22, 000	$1, 100	21, 200	$860	90, 300	4, 515	95, 900	4, 595
Bream and sunfish	23, 200	928	22, 500	900	85, 200	3, 522	89, 100	3, 609
Buffalo-fish	....	....	....	....	107, 600	1, 076	121, 700	1, 217
Catfish	24, 500	490	25, 100	502	88, 450	1, 687	93, 400	1, 794
Channel bass	43, 000	1, 722	43, 900	1, 756	184, 700	8, 277	261, 300	8, 757
Croakers	....	....	....	....	53, 950	1, 353	57, 325	1, 465
Drum, salt-water	....	....	....	....	2, 500	125	3, 200	160
Flounders	21, 500	860	23, 800	952	70, 100	2, 754	76, 550	3, 097
Mullet	63, 200	632	67, 700	677	721, 593	7, 000	305, 400	3, 479
Pickerel	....	....	....	....	12, 300	492	14, 750	590
Pinfish	11, 800	354	10, 800	324	54, 700	1, 585	55, 200	1, 593
Pompano	6, 150	615	6, 600	660	14, 025	1, 544	14, 875	1, 637
Sea bass	13, 200	466	13, 800	414	24, 500	1, 151	23, 660	1, 065
Sheepshead	23, 500	940	28, 900	1, 156	155, 700	6, 897	173, 200	7, 870
Spanish mackerel	14, 600	876	15, 100	906	43, 575	2, 956	46, 500	3, 150
Spots	14, 100	423	13, 400	402	45, 075	1, 352	45, 885	1, 375
Trout	34, 000	1. 700	34, 400	1, 720	370, 450	17, 163	372, 100	17, 596
Crabs, hard	6. 900	173	5, 900	221	48, 000	1, 307	32, 560	1, 307
Crabs, soft	12, 000	400	9, 800	490	19, 200	640	14, 600	730
Shrimp	45, 500	858	41, 600	830	794, 200	16, 741	613, 500	12, 622
Oysters	996, 093	26, 783	1, 125, 628	30, 271	5, 918, 521	167, 713	5, 645, 346	166. 672
Total	1, 375, 243	39, 320	1, 510, 128	43, 041	8, 933, 339	250, 884	8, 131, 401	245, 699

The vessel and shore fisheries.—The persons and property belonging to each of these branches have been shown in previous tables, so that it is only necessary in this place to consider the quantity and value of products accruing from each.

The fisheries prosecuted with vessels are much less extensive than those carried on with small boats. The fishing-grounds are so close to the shores that the use of vessels is not so necessary as if long voyages in the open gulf had to be made; and the trouble and expense incident to the customs regulations deter many fishermen from having craft of over 5 tons unless they are absolutely required by the nature of the fishing. In 1889 the species taken with vessels consisted of mullet, shrimp, and oysters, but in 1890 no mullet were obtained, the vessel fishery for that fish being only irregularly followed. As shown in Table 48, the vessel fisheries in 1889 yielded 3,183,006 pounds, valued at $68,773, and in 1890, 2,899,323 pounds, worth $72,234. Oysters constitute the great bulk of the output; in 1889 2,459,863 pounds (351,409 bushels), with a market value of $57,559, were taken, and in the following year 2,760,723 pounds (394,389 bushels), worth $69,610, were sold. The extent of the vessel fisheries in each county is also exhibited in the table; their importance in Harrison County is seen to greatly excel that of the other two counties combined.

The products of the boat or shore fisheries are given in Table 49. The aggregate catch in 1889 was 5,750,333 pounds, valued at $182,111, and in 1890 was 5,232,078 pounds, valued at $173,465. As in the vessel fisheries, oysters constitute the most important part of the yield; in 1889, 3,458,658 pounds of meats (equivalent to 494,094 bushels), worth $110,154, and in 1890, 2,884,623 pounds of meats (equal to 412,089 bushels), valued at $97,062, were taken. The general tendency of the shore oyster fishery in recent years has been toward a substantial increase, but, as shown in the table, there was a diminution in the output in 1890 as compared with 1889 of 82,005 bushels. This was due to a depletion of the oyster beds by freshets. The other most noticeable species in the shore fisheries, in the order of their importance, are trout, shrimp, channel bass, and sheepshead.

Harrison County leads in the importance of its shore fisheries as well as in its vessel fisheries, although the other counties have extensive interests.

48.—Table showing by species and counties the yield of the vessel fisheries of Mississippi in 1889 and 1890.

Species.	Jackson.				Harrison.				Hancock.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Mullet					271, 343	$2, 171							271, 343	$2, 171		
Shrimp	38, 600	$768	49, 000	$834	402, 800	8, 119	80, 000	$1, 600	10, 400	$156	9, 600	$190	451, 800	9, 043	138, 600	$2, 624
Oysters	379, 225	9, 580	403, 004	11, 632	1, 871, 779	42, 979	2, 077, 642	50, 985	208, 859	5, 000	280, 077	6, 992	*2, 459, 863	57, 559	†2, 760, 723	69, 610
Total	417, 825	10, 348	452, 004	12, 467	2, 545, 922	53, 269	2, 157, 642	52, 585	219, 259	5, 156	289, 677	7, 182	3, 183, 006	68, 773	2, 899, 323	72, 234

* 351,409 bushels.

† 394,389 bushels.

49.—Table showing by counties and species the yield of the shore fisheries of Mississippi in 1889 and 1890.

Species.	Jackson.				Harrison.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish	15, 900	$318	18, 550	$371	7, 600	$456	10, 800	$648
Black bass	....	....	....	....	5, 200	260	6, 000	300
Bluefish	45, 100	2, 255	49, 700	2, 485	23, 200	1, 160	25, 000	1, 250
Bream and sunfish	44, 300	1, 844	49, 600	1, 984	17, 700	750	17, 000	725
Buffalo-fish	107, 600	1, 076	121, 700	1, 217	....	....	....	....
Catfish	40, 950	737	46, 300	852	23, 000	460	22, 000	440
Channel bass	75, 300	3, 012	78, 400	2, 736	66, 400	3, 543	79, 000	4, 265
Croakers	42, 650	853	44, 025	880	11, 300	500	13, 300	585
Drum, salt-water	....	....	....	....	2, 500	125	3, 200	160
Flounders	28, 400	1, 056	32, 750	1, 310	20, 200	838	20, 000	835
Mullet	133, 300	1, 333	140, 200	1, 402	253, 750	2, 864	97, 500	1, 400
Pickerel	12, 300	492	14, 750	590	....	....	....	....
Pinfish	14, 400	369	15, 800	400	28, 500	862	28, 600	869
Pompano	4, 700	465	4, 775	477	3, 175	464	3, 500	500
Sea bass	5, 800	410	5, 660	441	5, 500	275	4, 200	210
Sheepshead	68, 700	2, 748	69, 900	2, 796	63, 500	3, 209	74, 400	3, 918
Spanish mackerel	13, 975	840	15, 600	876	15, 000	1, 240	15, 800	1, 368
Spots	17, 575	527	19, 985	598	13, 400	402	12, 500	375
Trout	245, 950	10, 363	246, 500	10, 666	90, 500	5, 100	91, 200	5, 210
Crabs, hard	4, 800	120	3, 200	120	36, 300	1, 014	23, 460	966
Crabs, soft	5, 400	180	3, 200	160	1, 800	60	1, 600	80
Shrimp	146, 800	2, 936	147, 900	2, 958	160, 500	4, 060	295, 000	6, 400
Oysters	697, 529	24, 855	765, 198	27, 490	1, 973, 895	63, 516	1, 273, 874	46, 293
Total	1, 771, 429	56, 789	1, 893, 693	60, 809	2, 822, 920	91, 158	2, 117, 934	76, 797

Species.	Hancock.				Total.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Angel-fish	....	....	....	....	23, 500	$774	29, 350	$1, 019
Black bass	....	....	....	....	5, 200	260	6, 000	300
Bluefish	22, 000	$1, 100	21, 200	$860	90, 300	4, 515	95, 900	4, 595
Bream and sunfish	23, 200	928	22, 500	900	85, 200	3, 522	89, 100	3, 609
Buffalo-fish	....	....	....	....	107, 600	1, 076	121, 700	1, 217
Catfish	24, 500	490	25, 100	502	88, 450	1, 687	93, 400	1, 794
Channel bass	40, 900	1, 722	43, 900	1, 756	184, 700	8, 277	201, 300	8, 757
Croakers	....	....	....	....	53, 950	1, 353	57, 325	1, 465
Drum, salt-water	....	....	....	....	2, 500	125	3, 200	160
Flounders	21, 500	860	23, 800	952	70, 100	2, 754	76, 550	3, 097
Mullet	63, 200	632	67, 700	677	450, 250	4, 829	305, 400	3, 479
Pickerel	....	....	....	....	12, 300	492	14, 750	590
Pinfish	11, 800	354	10, 800	324	54, 700	1, 585	55, 200	1, 593
Pompano	6, 150	615	6, 600	660	14, 025	1, 544	14, 875	1, 637
Sea bass	13, 200	466	13, 800	414	24, 500	1, 151	23, 660	1, 065
Sheepshead	23, 500	940	28, 900	1, 156	155, 700	6, 897	173, 200	7, 870
Spanish mackerel	14, 600	876	15, 100	906	43, 575	2, 956	46, 500	3, 150
Spots	14, 100	423	13, 400	402	45, 075	1, 352	45, 885	1, 375
Trout	34, 000	1, 700	34, 400	1, 720	370, 450	17, 163	372, 100	17, 596
Crabs, hard	6, 900	173	5, 900	221	48, 000	1, 307	32, 560	1, 307
Crabs, soft	12, 000	400	9, 800	490	19, 200	640	14, 600	730
Shrimp	35, 100	702	32, 000	640	342, 400	7, 698	474, 900	9, 998
Oysters	787, 234	21, 783	845, 551	23, 279	3, 458, 658	110, 154	2, 884, 623	97, 062
Total	1, 155, 984	34, 164	1, 220, 451	35, 859	5, 750, 333	182, 111	5, 232, 078	173, 465

Fisheries by apparatus.—In the following table the quantities and values of products taken with the different means of capture are shown in detail, by counties. In the vessel fisheries the species taken are so few and the apparatus so limited that no separate exhibition of this nature is required; but in the shore fisheries it is a matter of some interest to know the actual and relative importance of the different nets used in the capture of fish and other animals.

Considering fish proper, it is seen that the largest quantities are obtained with seines, which are credited with 1,599,645 pounds, valued at $55,087, in 1890; the total catch of fish in that year being 1,825,195 pounds, worth $64,368. Gill nets and trammel nets, the next important apparatus, took 220,750 pounds, with a market value of $9,185; and by means of lines only 4,800 pounds, worth $96, were obtained. In 1889, cast nets secured 20,000 pounds of mullet, valued at $200, but in the next year this means of capture was not employed in taking fish.

Seines are also used in the shrimp and crab fisheries, although some of the shrimp are caught in cast nets, and a small proportion of the crabs are taken with lines. Oysters, the only remaining product, are taken with tongs, which are the most productive apparatus in the State, 412,089 bushels, worth $97,062, being obtained in this way.

50.—Table showing by apparatus and species the yield of the shore fisheries of Mississippi in 1889 and 1890.

Apparatus and species.	Jackson.				Harrison.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Angel-fish	15,900	$318	18,550	$371	7,600	$456	10,800	$648
Bluefish	45,100	2,255	49,700	2,485	23,200	1,160	25,000	1,250
Bream and sunfish	12,700	580	13,800	552	13,500	540	12,500	500
Buffalo-fish	107,600	1,076	121,700	1,217	......	......	......	......
Catfish	40,950	737	46,300	852	18,500	370	17,200	344
Channel bass	75,300	3,012	78,400	2,736	56,700	3,058	68,500	3,740
Croakers	42,650	853	44,025	880	6,500	260	8,000	320
Flounders	28,400	1,056	32,750	1,310	17,200	688	16,500	660
Mullet	133,300	1,333	140,200	1,402	144,175	1,468	57,500	600
Pinfish	14,400	369	15,800	400	22,800	748	22,700	751
Pompano	4,700	465	4,775	477	3,175	464	3,500	500
Sea bass	5,800	410	5,660	441	5,500	275	4,200	210
Sheepshead	68,700	2,748	69,900	2,796	60,000	3,034	70,000	3,708
Spanish mackerel	13,975	840	15,600	876	15,000	1,240	15,800	1,368
Spots	17,575	527	19,985	598	13,400	402	12,500	375
Trout	175,000	6,906	168,900	6,756	82,500	4,700	81,700	4,735
Total	802,050	23,485	846,045	24,149	489,750	18,863	426,400	19,709
Trammel nets and gill nets:								
Black bass	......	......	......	......	5,200	260	6,000	300
Bream and sunfish	31,600	1,264	35,800	1,432	4,200	210	4,500	225
Channel bass	......	......	......	......	9,700	485	10,500	525
Croakers	......	......	......	......	4,800	240	5,300	265
Drum, salt-water	......	......	......	......	2,500	125	3,200	160
Flounders	......	......	......	......	3,000	150	3,500	175
Mullet	......	......	......	......	89,575	1,196	40,000	800
Pickerel	12,300	492	14,750	590	......	......	......	......
Pinfish	......	......	......	......	5,700	114	5,900	118
Sheepshead	......	......	......	......	3,500	175	4,200	210
Trout	70,950	3,457	77,600	3,910	8,000	400	9,500	475
Total	114,850	5,213	128,150	5,932	136,175	3,355	92,600	3,253
Cast nets:								
Mullet	......	......	......	......	20,000	200	......	......
Lines:								
Catfish	......	......	......	......	4,500	90	4,800	96
Miscellaneous:								
Crabs, hard	4,800	120	3,200	160	36,300	1,014	1,600	80
Crabs, soft	5,400	180	3,200	120	1,800	60	23,460	966
Shrimp	146,800	2,936	147,900	2,958	160,500	4,060	295,000	6,400
Oysters	697,529	24,855	765,198	27,490	1,973,895	63,516	1,273,874	46,293
Total	854,529	28,091	919,498	30,728	2,172,495	68,650	1,593,934	53,739
Grand total	1,771,429	56,789	1,893,693	60,809	2,822,920	91,158	2,117,734	76,797

50.—Table showing by apparatus and species the yield of the shore fisheries of Mississippi in 1889 and 1890—Continued.

Apparatus and species.	Hancock.				Total for State.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Angel-fish					23,500	$774	29,850	$1,019
Bluefish	22,000	$1,100	21,200	$860	90,300	4,515	95,900	4,595
Bream and sunfish	23,200	928	22,500	900	49,400	2,048	48,800	1,952
Buffalo-fish					107,600	1.076	121.700	1.217
Catfish	24.500	490	25,100	502	83.950	1,597	88,600	1,698
Channel bass	43,000	1,722	43,900	1,756	175,000	7,792	190,800	8,232
Croakers					49,150	1.113	52,025	1.200
Flounders	21,500	860	23,800	952	67.100	2,604	73,050	2,922
Mullet	63,200	632	67,700	677	340,675	3,433	265,400	2,679
Pinfish	11,800	354	10,800	324	49,000	1,471	49,300	1,475
Pompano	6,150	615	6,600	660	14,025	1,544	14,875	1,637
Sea bass	13.200	466	13,800	414	24,500	1,151	23,660	1.065
Sheepshead	23.500	940	28,900	1,156	152.200	6,722	168,800	7,660
Spanish mackerel	14,600	876	15,100	906	43.575	2.956	46.500	3,150
Spots	14.100	423	13,400	402	45,075	1,352	45,885	1,375
Trout	34,000	1.700	34,400	1,720	291,500	13,306	285,000	13,211
Total	314,750	11,106	327,200	11 229	1,606.550	53,454	1,599,645	55,087
Trammel nets and gill nets:								
Black bass					5.200	260	6,000	300
Bream and sunfish					35,800	1,474	40,300	1,657
Channel bass					9,700	485	10.500	525
Croakers					4.800	240	5,300	265
Drum, salt-water					2,500	125	3,200	160
Flounders					3,000	150	3,500	175
Mullet					89,575	1,196	40,000	800
Pickerel					12,300	492	14,750	590
Pinfish					5,700	114	5,900	118
Sheepshead					3,500	175	4,200	210
Trout					78,950	3,857	87,100	4,385
Total					251,025	8,568	220,750	9,185
Cast nets:								
Mullet					20,000	200		
Lines:								
Catfish					4,500	90	4,800	96
Miscellaneous:								
Crabs, hard	6,900	173	9,800	490	48,000	1,307	14,600	730
Crabs, soft	12,000	400	5,900	221	19,200	640	32.560	1,307
Shrimp	35,100	702	32,000	640	342,400	7,698	474,900	9,998
Oysters	787.234	21,783	845.551	23,279	*3,458,658	110,154	†2,884.623	97,062
Total	841,234	23,058	893,251	24,630	3,868,258	119,799	3,406,683	109,097
Grand total	1,155,984	34,164	1,220,451	35,859	5.750.333	182,111	5,231,878	173,465

* 494,094 bushels.

† 412,089 bushels.

The shore industries.—Perhaps no single factor has been so potent in bringing about the recent noteworthy increase in the fisheries of this State as the establishment of extensive canning and packing houses for the utilization of large quantities of raw products that would not otherwise find a market.

Chief among the shore industries is the oyster-canning business, which is prosecuted in every county, but is especially important in Harrison County. The canning of shrimps, which is mostly engaged in at oyster-canning establishments, is also extensive. The extent of the canning business in 1889 and 1890 is shown in the following table, in which the counties are combined to prevent the exhibition of private interests. Although the number of firms engaged in the canning of fishery products is small, the number of persons employed, the capital invested, and the value of the raw and manufactured products are important. In connection with the canning of oysters, there is a small trade in raw oysters carried on; in 1889 5,600 gallons and in 1890 1,200 gallons of oysters were opened, the value of which has been included with that of the manufactured products in the table.

51.—Table showing the extent of the canning industry of Mississippi.

Designation.	1889.	1890.	Designation.	1889.	1890.
Number of firms	8	7	Manufactured products:		
Number of persons employed	748	746	Oysters, 1-pound cans..No.	1, 614, 132	1, 872, 073
Value of plant	$85, 642	$75, 348	Oysters, 2-pound cans..do	882, 607	1, 076, 816
Cash capital	$190, 200	$184, 200	Value	*$208, 707	†$251, 490
Wages paid	$50, 976	$64, 679	Shrimp, ½-pound cans..No.	18, 960	4, 416
Raw products handled:			Shrimp, 1-pound cans..do	250, 008	174, 408
Oysters..........barrels	205, 573	256, 848	Value	$40, 766	$25, 588
Value	$90, 692	$115, 239			
Shrimp..........pounds	485, 300	191, 469			
Value	$10, 306	$4, 229			

* Includes $5,600, the value of oysters sold raw. † Includes $1,200, the value of oysters sold raw.

The business of opening oysters and shipping them in a raw condition is now a prominent feature of the fishing industry of Mississippi and is shown in detail by counties in Table 52. In 1890 the 23 wholesale firms engaged in this branch employed 270 persons, to whom $51,899 was paid in wages; the capital invested amounted to $93,173; the quantity of shell oysters handled was 165,179 barrels, for which $120,548 was paid to the fishermen; the selling value of the opened oysters was $225,306; and the enhancement in value by process of handling was $104,758, this sum representing the gross profits of the business.

52.—Table showing by counties the wholesale oyster-packing trade of Mississippi in 1889 and 1890.

Designation.	Jackson.		Harrison.		Hancock.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Number of firms	6	6	14	14	3	3	23	23
Number of employés	60	55	223	207	8	8	291	270
Value of property	$8, 750	$9, 513	$21, 145	$22, 410	$1, 400	$1, 400	$31, 295	$33, 323
Cash capital	$9, 800	$11, 100	$53, 100	$47, 450	$1, 200	$1, 300	$64, 100	$59, 850
Wages paid	$12, 762	$13, 496	$38, 831	$37, 135	$1, 155	$1, 268	$52, 748	$51, 899
Oysters handled:								
"Reefers"........bbls	30, 325	32, 900	42, 650	44, 400	3, 350	3, 700	76, 325	81, 000
Value paid	$18, 195	$19, 660	$21, 334	$21, 900	$1, 675	$1, 850	$41, 204	$43, 410
"Selects"........bbls	5, 085	5, 175	41, 378	40, 254	1, 200	1, 125	47, 663	46, 554
Value paid	$4, 068	$4, 140	$32, 137	$32, 611	$900	$844	$37, 105	$37, 595
"Plants"........bbls	3, 650	4, 275	29, 829	32, 625	750	725	34, 229	37, 625
Value paid	$4, 402	$5, 172	$30, 712	$33, 573	$825	$798	$35, 939	$39, 543
Total..........bbls	39, 060	42, 350	113, 857	117, 279	5, 300	5, 550	158, 217	165, 179
Value paid	$26, 665	$28, 972	$84, 183	$88, 084	$3, 400	$3, 492	$114, 248	$120, 548
Value of products as sold	$46, 840	$51, 947	$157, 092	$167, 467	$5, 750	$5, 892	$209, 682	$225, 306
Enhancement in value	$20, 175	$22, 975	$72, 909	$79, 383	$2, 350	$2, 400	$95, 434	$104, 758

The extent of the wholesale trade in fresh and salted fish is presented in a condensed form in Table 53. The figures show a decline in this business in 1890 as compared with 1889; this was due to the suspension of mullet packing at Biloxi. In 1889, 199,400 pounds of salt mullet and mullet roe were put up in packages holding 10, 15, 50, 100, and 200 pounds; the value of the pack was $11,370.

53.—Table showing the wholesale fish trade of Mississippi in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	9	8
Number of employés	26	15
Value of property	$2, 884	$2, 100
Cash capital	$8, 150	$7, 250
Wages paid	$6, 582	$4, 764
Fish handled..........pounds	2, 186, 293	1, 819, 245
Value paid	$58, 378	$55, 778
Value received	$82, 785	$73, 403
Enhancement in value	$24, 407	$17, 625

V.—FISHERIES OF LOUISIANA.

Geographical note.—The coast line of Louisiana, including the indentations, has a length of 1,650 miles; it is much more irregular than that of any other State in this region. Beginning in the east, the principal indentations are Lakes Pontchartrain and Borgne, Chandeleur Sound, Isle au Breton Sound, Barataria Bay, Timbalier Bay, Terrebonne Bay, Atchafalaya Bay, Grand Lake, Bay St. Bernard, Cote Blanche Bay, Vermillion Bay, Calcasieu Lake, and Sabine Lake; all of these are more or less important as fishing-grounds. The coastal region is also well supplied with rivers, and an almost infinite number of large and small islands occur, the most numerous and important group being the Chandeleur Islands, off the eastern end of the State, which, in addition to others, have a bearing on the fisheries.

New Orleans is the great fishing port of the State, as it is of the entire Gulf region. The quantity of fish, oysters, etc., entering the city is large and it makes this place rank among the prominent receiving centers for fishery products in the country. The only other fishing settlement of note is Morgan City, at the outlet of Grand Lake.

The statistics herein presented cover the fisheries of the entire coast region, and, in addition, the lakes and bays already named and the Mississippi River from its mouth to New Orleans.

General character of the fisheries.—Louisiana ranks second among the Gulf States in the value of its fisheries. It is surpassed by Florida by a considerable amount, and in turn is far in advance of all the other States. There are many products in the capture of which this State leads all others, among which are oysters, crabs, shrimp, crayfish, black bass, buffalo-fish, and catfish. The specially prominent products are oysters, shrimp, catfish, trout, sheepshead, and buffalo-fish, the value of the first named being nearly one-half that of the entire fishery output of the State. In the value of trout, sheepshead, and channel bass Louisiana ranks next to Texas, and in the catch of red snappers, Spanish mackerel, and alligators it is surpassed only by Florida.

The advance in the extent and importance of the fisheries since 1880 has been marked in all branches. The percentage of increase in the items of persons and capital has been greater than in any other State except Mississippi; the actual increase in the number of persons has been larger than elsewhere, and only Florida has excelled in the numerical increase in capital invested and value of products.

As in the case of the other States of this region, Louisiana has important undeveloped fishery resources, among which the oyster is chief. The large increase in the yield of this mollusk is shown elsewhere in this paper; and there will probably be an annual augmentation of the output as the result of increased demand and attention.

General statistics.—The number of persons engaged in the fishing industry of this State in 1890 was 4,068, of whom 332 were employed in the vessel fisheries, 3,276 in the shore or boat fisheries, and 460 in connection with the shore branches. A larger number of foreigners is found in the fisheries of Louisiana than in any other of the Gulf States. In the vessel fisheries there are 95 aliens, in the shore fisheries 1,006, and in the shore industries 198, giving a total of 1,299, or 32 per cent of the entire coast fishing population. The principal nationalities represented by this foreign element are Italian, Austrian, Malay, French, and Spanish. The number of colored American fishermen is 423, or about one-fifth the total number of citizens.

The fishery investment of this State was $706,557 in 1889, and $719,876 in 1890. The 119 vessels employed in 1890 were valued with their outfits at $93,527, exclusive of apparatus of capture. The value of the 2,578 boats used in the shore fisheries was $161,533. The seine is the principal form of apparatus; 168 seines were operated in 1890, worth $14,600. Lines were the next valuable means of capture; these were specially important in the shore fisheries, and almost insignificant in the vessel fisheries; $9,176 was invested in lines of various kinds. Dip nets and cast nets were extensively used, but had a less value than the tongs. The capital invested in shore property and the shore industries was $425,678, or more than half the total amount devoted to the fisheries.

The yield of the fisheries in 1889 was 20,947,239 pounds, valued at $621,048, and in 1890, 20,789,203 pounds, valued at $660,134. The diminished quantity in 1890 was due to a decline in the shrimp fishery, and the increased value of products depended on an augmented yield of oysters. The most important products and their values in 1890 were as follows: Oysters, $299,896; shrimp, $90,519; catfish, $54,726; trout, $33,026; sheepshead, $25,906; buffalo-fish, $22,940. The alligator industry, which is not included in the tables, yielded $20,150. Louisiana is the only Gulf State having a commercial fishery for crayfish; the value of this in 1890 was $7,030, a sum representing 140,650 pounds of these crustaceans.

The four tables which follow contain condensed figures giving the extent of the fisheries of this State in 1889 and 1890:

54.—Table of persons employed.

How engaged.	Number.	
	1889.	1890.
In vessel fisheries	324	317
On transporting vessels	17	15
In shore fisheries	3,175	3,276
On shore, in fish-houses, etc	450	460
Total	3,966	4,068

55.—Table showing the nationality of persons engaged in the fisheries of Louisiana in 1889 and 1890.

Nationalities.	Vessel fishermen.		Shore fishermen.		Shoresmen.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Americans, white	228	223	1,900	1,943	171	180	2,299	2,346
Americans, colored	15	14	326	327	76	82	417	423
Spaniards			85	91	45	41	130	132
Italians	45	45	316	320	64	62	425	427
Austrians	32	30	200	202	22	25	254	257
French			78	111	27	25	105	136
Germans			10	12			10	12
Chinese					30	30	30	30
Malays			160	165			160	165
Others	21	20	100	105	15	15	136	140
Total	341	332	3,175	3,276	450	460	3,966	4,068

56.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing (net tonnage in 1889, 843.71; in 1890, 834.94)	118	$53, 500	116	$51, 650
Outfit		20, 340		19, 627
Vessels transporting (net tonnage in 1889, 68.47; in 1890, 61.90)	4	16, 300	3	16, 000
Outfit		6, 355		6, 250
Boats	2, 499	161, 140	2, 578	161, 533
Apparatus of capture—vessel fisheries:				
Seines	21	1, 620	23	1, 770
Tongs	286	1, 942	267	1, 791
Lines		90		85
Apparatus of capture—shore fisheries:				
Seines	143	$13, 000	145	$12, 830
Cast nets	568	1, 756	574	1, 775
Dip nets	3, 505	2, 697	4, 130	2, 722
Tongs	1, 065	6, 922	1, 096	7, 124
Small traps		1, 950		1, 950
Lines		8, 161		9, 091
Shore property and accessories		234, 484		243, 178
Cash capital		176, 300		182, 500
Total		706, 557		719, 876

Note.—There should be added to the above figures $6,925 in 1889 and $7,025 in 1890, representing the value of the apparatus and outfits employed in hunting alligators.

57.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Black bass	80, 070	$4, 099	81, 570	$4, 219
Bluefish	12, 925	776	13, 050	843
Bream and sunfish	261, 520	15, 137	270, 020	15, 682
Buffalo-fish	1, 180, 700	22, 964	1, 180, 250	22, 940
Catfish	2, 437, 905	47, 151	2, 674, 007	54, 726
Channel bass	313, 600	10, 360	339, 316	11, 270
Croakers	149, 550	8, 805	158, 267	9, 479
Drum, fresh-water	11, 000	810	18, 200	1, 352
Flounders	21, 450	2, 145	25, 625	2, 407
Groupers	18, 500	185	17, 800	178
Mullet	283, 166	7, 775	287, 750	8, 021
Pompano	29, 000	3, 837	32, 450	4, 378
Rock bass	55, 600	3, 096	54, 200	3, 047
Sheepshead	364, 150	25, 022	390, 817	25, 906
Silver perch	135, 660	5, 936	140, 160	6, 206
Snappers, red	250, 400	7, 512	240, 500	7, 215
Spanish mackerel	133, 700	13, 370	144, 000	14, 665
Spots	30, 000	1, 500	30, 600	1, 520
Striped bass	54, 000	2, 940	49, 950	3, 050
Trout	619, 250	31, 441	655, 670	33, 026
Miscellaneous fish	153, 220	9, 200	161, 380	9, 319
Shrimp	7, 238, 500	95, 882	6, 662, 050	90, 519
Crayfish	138, 000	6, 900	140, 650	7, 030
Crabs, hard	842, 400	13, 820	850, 800	12, 815
Crabs, soft	147, 000	7, 765	129, 900	6, 547
Oysters	*5, 848, 640	269, 057	†5, 891, 095	299, 896
Turtles	84, 333	2, 175	90, 793	2, 335
Terrapins	53, 000	1, 388	58, 333	1, 543
Total	20, 947, 239	621, 048	20, 789, 203	660, 134

* 835,520 bushels. † 841,585 bushels.

Note.—The alligator industry, which is prosecuted in 14 counties in Louisiana included in this report, resulted in 1889 in the capture of 74, 240 alligators, the hides of which had a value of $38, 185; in 1890, 38, 588 animals were obtained, having a value of $21, 150. These figures are not included in the table.

The fisheries by parishes.—Eighteen parishes* bordering on the coast or immediately adjacent thereto, on the bays, lakes, and rivers named, have commercial fisheries. Beginning on the east, the parishes in their order are St. Tammany, Tangipahoa, St. John Baptist, St. Charles, Jefferson, Orleans, St. Bernard, Plaquemines, Lafourche, Terrebonne, St. Mary, Assumption, Iberville, St. Martin, Iberia, Vermilion, Cameron, and Calcasieu.

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* The geographical divisions generally known throughout the United States as counties are in Louisiana called parishes.

46.—Table showing by counties the number and value of vessels, boats, apparatus, etc., employed in the fisheries of Mississippi in 1889 and 1890.

Designation.	Jackson.				Harrison.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	8	$4,950	8	$4,900	47	$28,225	48	$27,500
Tonnage	88.17		88.17		413.40		415.78	
Outfit		1,782		1,500		8,966		9,850
Vessels transporting only							1	1,450
Tonnage							12.56	
Outfit								25
Boats	54	3,140	56	3,250	176	7,995	158	6,945
Apparatus of capture—vessel fisheries:								
Seines	5	260	5	250	27	1,960	27	2,050
Tongs	30	223	30	230	147	1,069	153	1,096
Apparatus of capture—shore fisheries:								
Seines	11	990	11	925	42	3,480	30	2,805
Trammel nets and gill nets	3	210	3	200	29	950	12	355
Cast nets					41	263	8	48
Lines						3		3
Tongs	81	525	82	522	164	1,010	122	770
Shore property		10,425		12,450		96,396		85,271
Cash capital		15,500		17,200		219,100		206,150
Total		38,005		41,427		369,417		344,318

Designation.	Hancock.				Total.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	4	$1,350	5	$2,550	59	$34,525	61	$34,950
Tonnage	39.95		53.51		544.52		557.46	
Outfit		910		984		11,658		12,334
Vessels transporting only							1	1,450
Tonnage							12.56	
Outfit								25
Boats	45	3,550	43	3,200	275	14,685	257	13,395
Apparatus of capture—vessel fisheries:								
Seines	1	35	1	50	33	2,255	33	2,350
Tongs	15	115	18	136	192	1,407	201	1,462
Apparatus of capture—shore fisheries:								
Seines	6	600	6	600	59	5,070	47	4,330
Trammel nets and gill nets					32	1,160	15	555
Cast nets					41	263	8	48
Lines						3		3
Tongs	78	468	74	445	323	2,003	278	1,737
Shore property		13,000		13,050		119,821		110,771
Cash capital		27,850		27,950		262,450		251,300
Total		47,878		48,965		455,300		434,710

59.—Table showing by parishes the apparatus and capital employed in the fisheries of Louisiana in 1889 and 1890—Continued.

Designation.	St. Bernard.				Plaquemines.				Lafourche.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					4	$1,900	4	$1,850	1	$300	1	$300
Outfit						470		473		100		86
Tonnage					25.25		25.25		5.73		5.73	
Vessels transporting					1	500	1	500				
Outfit						105		100				
Tonnage					7.41		7.41					
Boats	123	$2,100	116	$1,970	250	11,350	258	11,520	305	25,620	308	25,900
Apparatus of capture—vessel fisheries:												
Tongs					10	60	10	62	2	12	2	14
Apparatus of capture—shore fisheries:												
Seines	35	700	38	760					4	700	4	700
Cast nets	270	800	243	780					28	100	27	98
Dip nets	1,550	1,162	1,915	1,159	100	60	100	60				
Tongs					96	640	100	670	160	1,050	165	1,080
Small traps						1,950		1,950				
Lines		375		376		650		675		210		240
Shore property and accessories						2,925		3,450		4,220		4,430
Total		5,137		5,045		20,610		21,310		32,312		32,848

Designation.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	1	$500	3	$1,100	22	$7,600	22	$7,625				
Outfit		85		376		2,960		2,750				
Tonnage	5.54		19.74		147.65		142.43					
Vessels transporting					1	12,000	1	12,000				
Outfit						2,650		2,650				
Tonnage					46.32		46.32					
Boats	5.27	47,585	548	47,488	365	9,800	384	10,200	90	$1,635	92	$1,685
Apparatus of capture—vessel fisheries:												
Seines					1	100	2	185				
Tongs	2	15	7	49	42	315	42	294				
Lines												
Apparatus of capture—shore fisheries:												
Seines	3	500	3	500	8	1,060	7	920				
Cast nets	20	126	20	126	10	60	10	60				
Tongs	365	2,327	375	2,387	160	1,050	162	1,070				
Lines		225		234		2,806		3,431		1,480		1,610
Shore property and accessories		4,730		4,730		33,894		39,353		285		345
Cash capital				4,000		30,000		32,000				
Total		56,093		60,990		104,295		112,538		3,400		3,640

Designation.	Iberville.				St. Martin.				Iberia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	6	$110	7	$130	26	$640	26	$640	27	$655	28	$675
Lines		50		55		525		525		550		555
Shore property and accessories		20		25		115		120		115		120
Total		180		210		1,280		1,285		1,320		1,285

59.—*Table showing by parishes the apparatus aud capital employed in the fisheries of Louisiana in 1889 and 1890*—Continued.

Designation.	Vermilion.				Cameron.				Calcasieu.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	4	$200	5	$220	20	$500	20	$500	15	$300	16	$320
Tongs					4	25	4	25				
Lines		40		45		65		65		85		85
Shore property and accessories										200		200
Total		240		265		590		590		585		605

SUMMARY.

Designation.	1889.		1890.		Designation.	1889.		1890.	
	No.	Value.	No.	Value.		No.	Value.	No.	Value.
Vessels fishing	118	$53, 500	116	$51, 650	Apparatus of capture—shore fisheries:				
Outfit		20, 340		19, 627	Seines	143	$13, 000	145	$12, 830
Tonnage	843. 71		834. 94		Cast nets	568	1, 756	574	1, 775
Vessels transporting	4	16, 300	3	16, 000	Dip nets	3, 505	2, 697	4, 130	2, 722
Outfit		6, 355		6, 250	Tongs	1, 065	6, 922	1, 096	7, 124
Tonnage	68. 43		61. 90		Small traps		1, 950		1, 950
Boats	2, 499	161, 140	2, 578	161, 533	Lines		8, 161		9, 091
Apparatus of capture—vessel fisheries:					Shore property and accessories		234, 484		243, 178
Seines	21	1, 620	23	1, 770	Cash capital		176, 300		182, 500
Tongs	286	1, 942	267	1. 791	Total		706, 557		719, 876
Lines		90		85					

60.—*Table showing by parishes and species the yield of the fisheries of Louisiana in 1889 and 1890.*

Species.	St. Tammany.				Tangipahoa.				St. John Baptist.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass	2, 800	$224	3, 000	$240	2, 100	$168	2, 200	$176	1, 300	$104	1, 500	$120
Bream and sunfish	11, 200	1, 120	11, 200	1, 116	8, 100	810	8, 550	843	15, 500	1, 118	15, 750	1, 135
Buffalo-fish	8, 500	170	8, 700	174	15, 700	314	16, 500	330	140, 000	2. 800	130, 500	2, 610
Catfish	52, 400	1, 120	54, 000	1, 152	24, 740	620	26, 500	652	108, 000	2, 700	111, 050	2. 748
Croakers	700	70	500	50	5, 500	550	3, 200	320	5, 550	550	5, 800	580
Mullet									18, 900	567	18, 900	567
Rock bass	2, 000	120	1, 850	111	1, 700	102	1, 800	107	5, 200	260	5, 100	306
Sheepshead	3, 600	360	3, 600	360	3, 900	390	3, 900	390	18, 500	1, 850	18, 500	1, 850
Striped bass	5, 200	260	5, 000	300	2, 700	135	3, 000	180	6, 900	345	6, 500	390
Trout	17, 000	1, 216	17, 000	1, 222	19, 100	1, 388	19, 200	1, 395	30, 800	2, 186	30, 950	2, 197
Miscellaneous fish	7, 800	634	8, 300	652	8, 500	680	8, 875	693	9, 800	784	10, 290	801
Crayfish									26, 200	1, 300	26, 500	1, 325
Crabs, hard	1, 000	66	1, 000	67	1, 500	100	1, 500	100	2, 000	134	1, 700	113
Crabs, soft	8, 000	400	7. 500	375	7, 600	380	7, 200	360	10, 000	500	9, 800	490
Turtle	3, 833	95	5, 000	125	3, 000	75	3, 850	91	4, 500	102	5, 000	125
Total	124, 033	5, 855	126, 650	5, 944	104, 140	5, 712	106, 275	5, 637	403, 150	15, 300	397, 840	15, 357

60.—Table showing by parishes and species the yield of the fisheries of Louisiana in 1889 and 1890—Continued.

Species.	St. Charles.				Jefferson.				Orleans.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass	3,400	$272	3,500	$280	58,870	$2,403	58,920	$2,407	3,500	$280	3,850	$308
Bluefish									12,925	776	13,050	843
Bream and sunfish	16,400	740	16,750	763	77,170	2,982	77,395	2,998	32,500	2,810	38,015	3,157
Buffalo-fish	75,500	1,510	80,500	1,610	60,800	1,216	60,200	1,204	265,200	4,558	235,600	4,582
Catfish	96,000	2,000	100,000	2,072	172,500	2,960	198,375	3,977	165,750	4,143	173,108	4,248
Channel bass					108,000	2,240	109,150	2,718	75,100	3,755	67,450	3,373
Croakers	1,800	180	1,900	190	45,900	2,050	47,200	1,897	31,050	2,995	32,900	3,290
Drum, fresh-water											6,200	452
Flounders									11,450	1,145	12,225	1,223
Groupers									18,500	185	17,800	178
Mullet	26,600	913	18,133	628	153,851	3,686	120,467	2,670	31,500	982	32,210	1,056
Pompano									14,500	1,952	16,750	2,300
Rock bass	5,000	300	4,900	294	4,000	240	3,800	228	5,700	342	10,250	520
Sheepshead	6,500	650	6,500	650	93,400	4,190	97,200	4,592	41,325	4,067	40,950	4,020
Silver perch	2,000	60	2,000	60	62,660	2,456	62,660	2,456	22,700	1,362	26,300	1,578
Snappers, red									250,400	7,512	240,500	7,215
Spanish mackerel	10,800	1,080	4,800	480	5,200	520	11,200	1,120	63,700	6,370	70,315	7,155
Striped bass	3,100	155	3,500	210	3,800	190	4,000	240	8,500	425	8,000	500
Trout	27,100	1,952	27,190	1,945	227,000	11,814	227,200	11,834	58,050	4,276	59,760	4,356
Miscellaneous fish	4,600	368	5,150	388	7,200	576	7,480	586	69,700	4,276	70,400	4,127
Shrimp					6,086,000	76,780	5,544,000	72,590	216,600	4,234	221,800	4,454
Crayfish	27,600	1,380	28,000	1,400	25,400	1,270	26,000	1,300	38,400	1,930	38,850	1,940
Crabs, hard	2,500	116	1,800	120	794,800	10,647	823,900	11,022	26,600	1,774	10,200	680
Crabs, soft	5,000	250	5,000	250	5,000	250	4,800	240	31,400	1,950	27,900	1,595
Oysters					832,881	37,801	763,280	44,713	1,996,379	64,210	2,068,017	66,991
Turtles	1,000	17	1,350	24	11,000	270	10,867	247	2,500	62	3,700	86
Terrapins	2,000	58	2,500	67	2,500	67	3,333	108				
Total	316,900	12,051	313,473	11,431	8,837,932	164,608	8,261,427	169,147	3,493,929	126,371	3,546,100	130,227

Species.	St. Bernard.				Plaquemines.				Lafourche.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass	8,100	$648	8,600	$688								
Bream and sunfish	44,650	3,877	46,360	3,990	6,000	$180	6,000	$180	4,000	$120	4,000	$120
Buffalo-fish	355,000	7,846	405,250	8,105	150,000	3,000	150,000	3,000	5,000	75	4,000	60
Catfish	440,860	7,325	452,437	7,462	265,000	5,300	265,000	5,300	10,000	150	12,000	200
Channel bass	20,500	1,025	20,200	1,010	23,000	800	23,650	650	20,000	650	20,650	568
Croakers	9,050	910	10,000	1,000	9,000	270	9,667	367	9,000	270	10,250	390
Drum, fresh-water	11,000	810	12,000	900								
Flounders	10,000	1,000	000	1,100								
Mullet	52,315	1,627	94,590	2,979								
Pompano	14,500	1,885	15,700	2,078								
Rock bass	32,000	1,732	26,500	1,481								
Sheepshead	104,925	9,630	105,000	9,590	14,000	520	15,753	631	16,000	680	17,864	715
Silver perch	20,300	1,218	200	1,272	3,000	90	3,000	90	2,000	60	2,000	60
Spanish mackerel	54,000	5,400	57,685	5,910								
Spots	30,000	1,500	30,600	1,520								
Striped bass	23,800	1,430	19,950	1,230								
Trout	43,200	3,149	45,220	3,271	40,000	1,320	41,700	1,250	43,000	1,400	45,300	1,355
Miscellaneous fish	45,620	1,882	46,785	1,928								
Shrimp	125,900	2,518	120,500	2,410	120,000	2,700	118,750	2,225	50,000	1,200	47,000	705
Crayfish	20,400	1,020	21,300	1,065								
Crabs, hard	14,000	933	10,700	713								
Crabs, soft	80,000	4,035	67,700	3,237								
Oysters					583,765	56,400	564,886	57,035	509,600	24,870	481,684	29,910
Turtles	7,500	154	9,066	212					3,000	150	3,000	150
Total	1,567,620	61,554	1,658,343	63,151	1,213,765	70,580	1,198,406	70,728	671,600	29,625	647,748	34,233

60.—Table showing by parishes and species the yield of the fisheries of Louisiana in 1889 and 1890—Continued.

Species.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	16,000	$480	16,000	$480	10,000	$300	10,000	$300	....	....	....	....
Buffalo-fish	40,000	575	34,000	500	65,000	900	55,000	765	....	....	....	....
Catfish	20,000	350	23,500	375	555,680	10,363	658,127	14,860	230,640	$4,950	274,060	$6,110
Channel bass	50,000	1,400	50,470	1,388	17,000	490	47,746	1,563	....	....	....	....
Croakers	18,000	540	19,250	732	14,000	420	17,600	663	....	....	....	....
Flounders	....	....	....	....	....	....	2,400	84	....	....	....	....
Groupers	....	....	....	....	....	....	....	....	....	....	....	....
Mullet	....	....	....	....	....	....	3,450	121	....	....	....	....
Sheepshead	37,000	1,410	38,500	1,540	25,000	1,275	43,050	1,568	....	....	....	....
Silver perch	8,000	240	8,000	240	5,000	150	5,000	150	....	....	....	....
Snappers, red	....	....	....	....	....	....	....	....	....	....	....	....
Trout	80,000	1,580	82,125	2,215	34,000	1,160	60,025	1,986	....	....	....	....
Miscellaneous fish	....	....	....	....	....	....	4,100	144	....	....	....	....
Shrimp	600,000	8,000	575,000	7,670	40,000	450	35,000	465	....	....	....	....
Oysters	1,117,200	49,200	1,133,090	60,508	777,315	35,326	848,638	39,489	....	....	....	....
Turtles	18,000	450	18,460	462	30,000	800	30,500	813	....	....	....	....
Terrapins	....	....	....	....	48,500	1,263	52,500	1,368	....	....	....	....
Total	2,004,200	64,225	1,998,395	76,110	1,621,495	52,897	1,878,136	64,339	230,640	4,950	274,060	6,110

Species.	Iberville.				St. Martin.				Iberia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Catfish	15,000	$280	17,500	$320	84,300	$1,530	89,500	$1,600	92,035	$1,560	98,850	$1,650

Species.	Vermilion.				Cameron.				Calcasieu.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	8,000	$240	8,000	$240	12,000	$360	12,000	$360	....	....	....	....
Catfish	25,000	400	30,000	500	35,000	600	40,000	650	45,000	$800	50,000	$850
Silver perch	4,000	120	4,000	120	6,000	180	6,000	180	....	....	....	....
Oysters	6,300	250	6,300	250	25,200	1,000	25,200	1,000	....	....	....	....
Total	43,300	1,010	48,300	1,110	78,200	2,140	83,200	2,190	45,000	800	50,000	850

SUMMARY.

Species.	1889.		1890.		Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.	Pounds.	Value.
Black bass	80,070	$4,099	81,570	$4,219	Snappers, red	250,400	$7,512	240,500	$7,215
Bluefish	12,925	776	13,050	843	Spanish mackerel	133,700	13,370	144,000	14,665
Bream and sunfish	261,520	15,137	270,020	15,682	Spots	30,000	1,500	30,600	1,520
Buffalo-fish	1,180,700	22,964	1,180,250	22,940	Striped bass	54,000	2,940	49,950	3,050
Catfish	2,437,905	47,151	2,674,007	54,726	Trout	619,250	31,441	655,670	33,026
Channel bass	313,600	10,360	339,316	11,270	Miscellaneous fish	153,220	9,200	161,380	9,319
Croakers	149,550	8,805	158,267	9,479	Shrimp	7,238,500	95,882	6,662,050	90,519
Drum, fresh-water	11,000	810	18,200	1,352	Crayfish	138,000	6,900	140,650	7,030
Flounders	21,450	2,145	25,625	2,407	Crabs, hard	842,400	13,820	850,800	12,815
Groupers	18,500	185	17,800	178	Crabs, soft	147,000	7,765	129,900	6,547
Mullet	283,166	7,775	287,750	8,021	Oysters	5,848,640	269,057	5,891,095	299,896
Pompano	29,000	3,837	32,450	4,378	Turtles	84,333	2,175	90,793	2,335
Rock bass	55,600	3,096	54,200	3,047	Terrapins	53,000	1,388	58,333	1,543
Sheepshead	364,150	25,022	390,817	25,906					
Silver perch	135,660	5,936	140,160	6,206	Total	20,947,239	621,048	20,789,203	660,134

Products of the vessel and shore fisheries.—Vessels are employed in only six parishes of Louisiana, viz, Orleans, St. Mary, Jefferson, Lafourche, Terrebonne, and Plaquemines, in only the first two of which are the vessel fisheries important. Oysters are taken in all these parishes, but only in Orleans and St. Mary are fish and crustaceans obtained with vessels. The aggregate yield of the vessel fisheries in 1890 was 3,595,070 pounds, for which the fishermen received $133,188. The quantity of products taken by vessels of Orleans Parish in 1890 was 2,765,792 pounds, valued at $98,386, of which 2,068,017 pounds, worth $66,991, were oysters. In the parish of St. Mary the yield was 559,638 pounds, valued at $24,936, of which 428,638 pounds and $20,489 represented oysters. The importance of the oysters is thus clearly shown. The most prominent fish obtained with vessels are red snappers, channel bass, trout, Spanish mackerel, croakers, and sheepshead. Compared with the yield of the shore fisheries all of these are unimportant.

The products of the shore or boat fisheries in 1890 amounted to 17,194,133 pounds, with a market value of $526,946. From these figures it will be seen that the vessel fisheries are much less extensive than the shore fisheries, the output of the latter exceeding that of the former in the case of almost every species. The value of the oysters was $202,550, after which the most remunerative products were shrimp, worth $88,115; catfish, worth $54,155; trout, worth $29,508; sheepshead, worth $23,728; and buffalo-fish, worth $22,695. The shore fisheries of Jefferson Parish are the most valuable, while Orleans Parish, which ranked first in the vessel fisheries, is surpassed by the parishes of Terrebonne, Plaquemines, St. Bernard, St. Mary, and Lafourche.

The products of the vessel and shore fisheries in 1889 and 1890 are shown in detail in Tables 61 and 62, the specification being by parishes.

61.—Table showing by parishes and species the yield of the vessel fisheries of Louisiana in 1889 and 1890.

Parishes and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Jefferson:				
Oysters	202,881	$6,801	158,480	$5,413
Orleans:				
Bluefish	12,925	776	13,050	843
Bream and sunfish	14,150	1,158	18,050	1,385
Buffalo-fish	10,700	214	12,250	245
Catfish	21,750	543	22,650	571
Channel bass	64,900	3,245	56,450	2,825
Croakers	24,050	2,295	26,800	2,680
Flounders	6,450	645	7,025	703
Groupers	18,500	185	17,800	178
Pompano	4,850	729	5,900	885
Rock bass	1,700	102	1,800	108
Sheepshead	14,525	1,387	14,150	1,340
Silver perch	14,500	870	16,300	978
Snappers, red	250,400	7,512	240,500	7,215
Spanish mackerel	26,700	2,670	30,150	3,015
Trout	21,750	1,716	21,700	1,682
Miscellaneous fish	56,000	3,380	56,000	3,205
Shrimp	117,000	2,242	121,900	2,404
Crabs, hard	24,600	1,640	8,400	560
Crabs, soft	11,400	950	6,900	575
Oysters	1,996,379	64,210	2,068,017	66,981
Total	2,713,229	96,469	2,765,792	98,386
Plaquemines:				
Oysters	37,765	1,400	29,386	1,035
Lafourche:				
Oysters	26,600	870	30,184	910
Terrebonne:				
Oysters	4,200	200	51,590	2,508
St. Mary:				
Channel bass	10,000	290	40,000	1,350
St. Mary—continued.				
Croakers			2,100	$74
Flounders			2,400	84
Mullet			3,450	121
Sheepshead	8,000	$355	24,800	838
Trout	30,000	1,060	54,150	1,836
Miscellaneous fish			4,100	144
Oysters	357,315	16,326	428,638	20,489
Total	405,315	18,031	559,638	24,936
Summary:				
Bluefish	12,925	776	13,050	843
Bream and sunfish	14,150	1,158	18,050	1,385
Buffalo-fish	10,700	214	12,250	245
Catfish	21,750	543	22,650	571
Channel bass	74,900	3,535	96,450	4,173
Croakers	24,050	2,295	28,900	2,754
Flounders	6,450	645	9,425	787
Groupers	18,500	185	17,800	178
Mullet			3,450	121
Pompano	4,850	729	5,900	885
Rock bass	1,700	102	1,800	108
Sheepshead	22,525	1,742	38,950	2,178
Silver perch	14,500	870	16,300	978
Snappers, red	250,400	7,512	240,500	7,215
Spanish mackerel	26,700	2,670	30,150	3,015
Trout	51,750	2,776	75,850	3,518
Miscellaneous fish	56,000	3,380	60,100	3,349
Shrimp	117,000	2,242	121,900	2,404
Crabs, hard	24,600	1,640	8,400	560
Crabs, soft	11,400	950	6,900	575
Oysters	2,625,140	89,807	2,766,295	97,346
Grand total	3,389,990	123,771	3,595,070	133,188

60.—Table showing by parishes and species the yield of the fisheries of Louisiana in 1889 and 1890—Continued.

Species.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	16,000	$480	16,000	$480	10,000	$300	10,000	$300	....	....	....	....
Buffalo-fish	40,000	575	34,000	500	65,000	900	55,000	765	....	....	....	....
Catfish	20,000	350	23,500	375	555,680	10,363	658,127	14,860	230,640	$4,950	274,060	$6,110
Channel bass	50,000	1,400	50,470	1,388	17,000	490	47,746	1,563	....	....	....	....
Croakers.........	18,000	540	19,250	732	14,000	420	17,600	663	....	....	....	....
Flounders	....	....	....	....	....	....	2,400	84	....	....	....	....
Groupers	....	....	....	....	....	....	....	....	....	....	....	....
Mullet..........	....	....	....	....	....	....	3,450	121	....	....	....	....
Sheepshead......	37,000	1,410	38,500	1,540	25,000	1,275	43,050	1,568	....	....	....	....
Silver perch.....	8,000	240	8,000	240	5,000	150	5,000	150	....	....	....	....
Snappers, red....	....	....	....	....	....	....	....	....	....	....	....	....
Trout...........	80,000	1,580	82,125	2,215	34,000	1,160	60,025	1,986	....	....	....	....
Miscellaneous fish	....	....	....	....	....	....	4,100	144	....	....	....	....
Shrimp	600,000	8,000	575,000	7,670	40,000	450	35,000	465	....	....	....	....
Oysters..........	1,117,200	49,200	1,133,090	60,508	777,315	35,326	848,638	39,489	....	....	....	....
Turtles	18,000	450	18,460	462	30,000	800	30,500	813	....	....	....	....
Terrapins.......	....	....	....	....	48,500	1,263	52,500	1,368	....	....	....	....
Total	2,004,200	64,225	1,998,395	76,110	1,621,495	52,897	1,878,136	64,339	230,640	4,950	274,060	6,110

Species.	Iberville.				St. Martin.				Iberia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Catfish	15,000	$280	17,500	$320	84,300	$1,530	89,500	$1,600	92,035	$1,560	98,850	$1,650

Species.	Vermilion.				Cameron.				Calcasieu.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	8,000	$240	8,000	$240	12,000	$360	12,000	$360	....	....	....	....
Catfish	25,000	400	30,000	500	35,000	600	40,000	650	45,000	$800	50,000	$850
Silver perch	4,000	120	4,000	120	6,000	180	6,000	180	....	....	....	....
Oysters	6,300	250	6,300	250	25,200	1,000	25,200	1,000	....	....	....	....
Total	43,300	1,010	48,300	1,110	78,200	2,140	83,200	2,190	45,000	800	50,000	850

SUMMARY.

Species.	1889.		1890.		Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.	Pounds.	Value.
Black bass.............	80,070	$4,099	81,570	$4,219	Snappers, red.........	250,400	$7,512	240,500	$7,215
Bluefish	12,925	776	13,050	843	Spanish mackerel.....	133,700	13,370	144,000	14,665
Bream and sunfish....	261,520	15,137	270,020	15,682	Spots	30,000	1,500	30,600	1,520
Buffalo-fish	1,180,700	22,964	1,180,250	22,940	Striped bass	54,000	2,940	49,950	3,050
Catfish	2,437,905	47,151	2,674,007	54,726	Trout..................	619,250	31,441	655,670	33,026
Channel bass	313,600	10,360	339,316	11,270	Miscellaneous fish....	153,220	9,200	161,380	9,319
Croakers	149,550	8,805	158,267	9,479	Shrimp	7,238,500	95,882	6,662,050	90,519
Drum, fresh-water....	11,000	810	18,200	1,352	Crayfish	138,000	6,900	140,650	7,030
Flounders	21,450	2,145	25,625	2,407	Crabs, hard	842,400	13,820	850,800	12,815
Groupers	18,500	185	17,800	178	Crabs, soft...........	147,000	7,765	129,900	6,547
Mullet.................	283,166	7,775	287,750	8,021	Oysters	5,848,640	269,057	5,891,095	299,896
Pompano	29,000	3,837	32,450	4,378	Turtles	84,333	2,175	90,793	2,335
Rock bass	55,600	3,096	54,200	3,047	Terrapins.............	53,000	1,388	58,333	1,543
Sheepshead...........	364,150	25,022	390,817	25,906					
Silver perch	135,660	5,936	140,160	6,206	Total	20,947,239	621,048	20,789,203	660,134

62.—Table showing by parishes and species the yield of the shore fisheries of Louisiana in 1889 and 1890—Continued.

Species.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	16,000	$480	16,000	$480	10,000	$300	10,000	$300				
Buffalo-fish	40,000	575	34,000	500	65,000	900	55,000	765				
Catfish	20,000	350	23,500	375	555,680	10,363	658,127	14,860	230,640	$4,950	274,060	$6,110
Channel bass	50,000	1,400	50,470	1,388	7,000	200	7,746	213				
Croakers	18,000	540	19,250	732	14,000	420	15,500	589				
Sheepshead	37,000	1,410	38,500	1,540	17,000	920	18,250	730				
Silver perch	8,000	240	8,000	240	5,000	150	5,000	150				
Trout	80,000	1,580	82,125	2,215	4,000	100	5,875	150				
Shrimp	600,000	8,000	575,000	7,670	40,000	450	35,000	465				
Oysters	1,113,000	49,000	1,081,500	58,000	420,000	19,000	420,000	19,000				
Turtles	18,000	450	18,460	462	30,000	800	30,500	813				
Terrapins					48,500	1,263	52,500	1,368				
Total	2,000,000	64,025	1,946,805	73,602	1,216,180	34,866	1,313,498	39,403	230,640	4,950	274,060	6,110

Species.	Iberville.				St. Martin.				Iberia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Catfish	15,000	$280	17,500	$320	84,300	$1,530	89,500	$1,600	92,035	$1,560	98,850	$1,650

Species.	Vermilion.				Cameron.				Calcasieu.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	8,000	$240	8,000	$240	12,000	$360	12,000	$360				
Catfish	25,000	400	30,000	500	35,000	600	40,000	650	45,000	$800	50,000	$850
Silver perch	4,000	120	4,000	120	6,000	180	6,000	180				
Oysters	6,300	250	6,300	250	25,200	1,000	25,200	1,000				
Total	43,300	1,010	48,300	1,110	78,200	2,140	83,200	2,190	45,000	800	50,000	850

SUMMARY.

Species.	1889.		1890.		Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.	Pounds.	Value.
Black bass	80,070	$4,099	81,570	$4,219	Spots	30,000	$1,500	30,600	$1,520
Bream and sunfish	247,370	13,979	251,970	14,297	Striped bass	54.000	2,940	49,950	3,050
Buffalo-fish	1,170.000	22.750	1,168.000	22,695	Trout	567,500	28,665	579,820	29,508
Catfish	2,416,155	46,608	2,651,357	54,155	Miscellaneous fish	97,220	5,820	101,280	5,970
Channel bass	238,700	6,825	242,866	7,097	Shrimp	7,121,500	93,640	6,540,150	88,115
Croakers	125,500	6,510	129,367	6,725	Crayfish	138,000	6,900	140,650	7,030
Drum, fresh-water	11,000	810	18,200	1,352	Crabs, hard	817,800	12,180	842,400	12,255
Flounders	15,000	1,500	16,200	1,620	Crabs, soft	135,600	6,815	123,000	5,972
Mullet	283,166	7,775	284,300	7,900	Oysters	3.223,500	179,250	3,124,800	202,550
Pompano	24,150	3,108	26,550	3,493	Turtles	84,333	2,175	90,793	2,335
Rock bass	53,900	2,994	52,400	2,939	Terrapins	53,000	1,388	58,333	1,543
Sheepshead	341,625	23,280	351,867	23,728					
Silver perch	121,160	5,066	123,860	5,228	Total	17,557,249	497.277	17,194,133	526,946
Spanish mackerel	107,000	10,700	113,850	11,650					

62.—Table showing by parishes and species the yield of the shore fisheries of Louisiana in 1889 and 1890.

Species.	St. Tammany.				Tangipahoa.				St. John Baptist.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass	2,800	$224	3,000	$240	2,100	$168	2,200	$176	1,300	$104	1,500	$120
Bream and sunfish	11,200	1,120	11,200	1,116	8,100	810	8,550	843	15,500	1,118	15,750	1,135
Buffalo-fish	8,500	170	8,700	174	15,700	314	16,500	330	140,000	2,800	130,500	2,610
Catfish	52,400	1,120	54,000	1,152	24,740	620	26,500	652	108,000	2,700	111,050	2,748
Croakers	700	70	500	50	5,500	550	3,200	320	5,550	550	5,800	580
Mullet									18,900	567	18,900	567
Rock bass	2,000	120	1,850	111	1,700	102	1,800	107	5,200	260	5,100	306
Sheepshead	3,600	360	3,600	360	3,900	390	3,900	390	18,500	1,850	18,500	1,850
Striped bass	5,200	260	5,000	300	2,700	135	3,000	180	6,900	345	6,500	390
Trout	17,000	1,216	17,000	1,222	19,100	1,388	19,200	1,395	30,800	2,186	30,950	2,197
Miscellaneous fish	7,800	634	8,300	652	8,500	680	8,875	693	9,800	784	10,290	801
Crayfish									26,200	1,300	26,500	1,325
Crabs, hard	1,000	66	1,000	67	1,500	100	1,500	100	2,000	134	1,700	113
Crabs, soft	8,000	400	7,500	375	7,600	380	7,200	360	10,000	500	9,800	490
Turtles	3,833	95	5,000	125	3,000	75	3,850	91	4,500	102	5,000	175
Total	124,033	5,855	126,650	5,944	104,140	5,712	106,275	5,637	403,150	15,300	397,840	15,357

Species.	St. Charles.				Jefferson.				Orleans.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass	3,400	$272	3,500	$280	58,870	$2,403	58,920	$2,407	3,500	$280	3,850	$308
Bream and sunfish	16,400	740	16,750	763	77,170	2,982	77,395	2,998	18,350	1,652	19,965	1,772
Buffalo-fish	75,500	1,510	80,500	1,610	60,800	1,216	60,200	1,204	254,500	4,344	223,350	4,337
Catfish	96,000	2,000	100,000	2,072	172,500	2,960	198,375	3,977	144,000	3,600	150,458	3,677
Channel bass					108,000	2,240	109,150	2,718	10,200	510	11,000	550
Croakers	1,800	180	1,900	190	45,900	2,050	47,200	1,897	7,000	700	6,100	610
Drum, fresh-water											6,200	452
Flounders									5,000	500	5,200	520
Mullet	26,600	913	18,133	628	153,851	3,686	120,467	2,670	31,500	982	32,210	1,056
Pompano									9,650	1,223	10,850	1,415
Rock bass	5,000	300	4,900	294	4,000	240	3,800	228	4,000	240	8,450	412
Sheepshead	6,500	650	6,500	650	93,400	4,190	97,200	4,592	26,800	2,680	26,800	2,680
Silver perch	2,000	60	2,000	60	62,660	2,456	62,660	2,456	8,200	492	10,000	600
Spanish mackerel	10,800	1,080	4,800	480	5,200	520	11,200	1,120	37,000	3,700	40,165	4,140
Striped bass	3,100	155	3,500	210	3,800	190	4,000	240	8,500	425	8,000	500
Trout	27,100	1,952	27,190	1,945	227,000	11,814	227,200	11,834	36,300	2,560	38,060	2,674
Miscellaneous fish	4,600	368	5,150	388	7,200	576	7,480	586	13,700	896	14,400	922
Shrimp					6,086,000	76,780	5,544,000	72,590	99,600	1,992	99,900	2,050
Crayfish	27,600	1,380	28,000	1,400	25,400	1,270	26,000	1,300	38,400	1,930	38,850	1,940
Crabs, hard	2,500	166	1,800	120	794,800	10,647	823,900	11,022	2,000	134	1,800	120
Crabs, soft	5,000	250	5,000	250	5,000	250	4,800	240	20,000	1,000	21,000	1,020
Oysters					630,000	31,000	604,800	39,300				
Turtles	1,000	17	1,350	24	11,000	270	10,867	247	2,500	62	3,700	86
Terrapins	2,000	58	2,500	67	2,500	67	3,333	108				
Total	316,900	12,051	313,473	11,431	8,635,051	157,807	8,102,947	163,734	780,700	29,902	780,308	31,841

Species.	St. Bernard.				Plaquemines.				Lafourche.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Black bass	8,100	$648	8,600	$688								
Bream and sunfish	44,650	3,877	46,360	3,990	6,000	$180	6,000	$180	4,000	$120	4,000	$120
Buffalo-fish	355,000	7,846	405,250	8,105	150,000	3,000	150,000	3,000	5,000	75	4,000	60
Catfish	440,860	7,325	452,437	7,462	265,000	5,300	265,000	5,300	10,000	150	12,000	200
Channel bass	20,500	1,025	20,200	1,010	23,000	800	23,650	650	20,000	650	20,650	568
Croakers	9,050	910	10,000	1,000	9,000	270	9,667	367	9,000	270	10,250	390
Drum, fresh-water	11,000	810	12,000	900								
Flounders	10,000	1,000	11,000	1,100								
Mullet	52,315	1,627	94,590	2,979								
Pompano	14,500	1,885	15,700	2,078								
Rock bass	32,000	1,732	26,500	1,481								
Sheepshead	104,925	9,630	105,000	9,590	14,000	520	15,753	631	16,000	680	17,864	715
Silver perch	20,300	1,218	21,200	1,272	3,000	90	3,000	90	2,000	60	2,000	60
Spanish mackerel	54,000	5,400	57,685	5,910								
Spots	30,000	1,500	30,600	1,520								
Striped bass	23,800	1,430	19,950	1,230								
Trout	43,200	3,149	45,220	3,271	40,000	1,320	41,700	1,250	43,000	1,400	45,300	1,355
Miscellaneous fish	45,620	1,882	46,785	1,928								
Shrimp	125,900	2,518	120,500	2,410	120,000	2,700	118,750	2,225	50,000	1,200	47,000	705
Crayfish	20,400	1,020	21,300	1,065								
Crabs, hard	14,000	933	10,700	713								
Crabs, soft	80,000	4,035	67,700	3,237								
Oysters					546,000	55,000	535,500	56,000	483,000	24,000	451,500	29,000
Turtle	7,500	154	9,066	212					3,000	150	3,000	150
Total	1,567,620	61,554	1,658,343	63,151	1,176,000	69,180	1,169,020	69,693	645,000	28,755	617,564	33,323

62.—*Table showing by parishes and species the yield of the shore fisheries of Louisiana in 1889 and 1890*—Continued.

Species.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	16,000	$480	16,000	$480	10,000	$300	10,000	$300	......	......	......	......
Buffalo-fish	40,000	575	34,000	500	65,000	900	55,000	765	......	......	......	......
Catfish	20,000	350	23,500	375	555,680	10,363	658,127	14,860	230,640	$4,950	274,060	$6,110
Channel bass	50,000	1,400	50,470	1,388	7,000	200	7,746	213	......	......	......	......
Croakers	18,000	540	19,250	732	14,000	420	15,500	589	......	......	......	......
Sheepshead	37,000	1,410	38,500	1,540	17,000	920	18,250	730	......	......	......	......
Silver perch	8,000	240	8,000	240	5,000	150	5,000	150	......	......	......	......
Trout	80,000	1,580	82,125	2,215	4,000	100	5,875	150	......	......	......	......
Shrimp	600,000	8,000	575,000	7,670	40,000	450	35,000	465	......	......	......	......
Oysters	1,113,000	49,000	1,081,500	58,000	420,000	19,000	420,000	19,000	......	......	......	......
Turtles	18,000	450	18,460	462	30,000	800	30,500	813	......	......	......	......
Terrapins	......	......	......	......	48,500	1,263	52,500	1,368	......	......	......	......
Total	2,000,000	64,025	1,946,805	73,602	1,216,180	34,866	1,313,498	39,403	230,640	4,950	274,060	6,110

Species.	Iberville.				St. Martin.				Iberia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Catfish	15,000	$280	17,500	$320	84,300	$1,530	89,500	$1,600	92,035	$1,560	98,850	$1,650

Species.	Vermilion.				Cameron.				Calcasieu.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and sunfish	8,000	$240	8,000	$240	12,000	$360	12,000	$360	......	......	......	......
Catfish	25,000	400	30,000	500	35,000	600	40,000	650	45,000	$800	50,000	$850
Silver perch	4,000	120	4,000	120	6,000	180	6,000	180	......	......	......	......
Oysters	6,300	250	6,300	250	25,200	1,000	25,200	1,000	......	......	......	......
Total	43,300	1,010	48,300	1,110	78,200	2,140	83,200	2,190	45,000	800	50,000	850

SUMMARY.

Species.	1889.		1890.		Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.		Pounds.	Value.	Pounds.	Value.
Black bass	80,070	$4,099	81,570	$4,219	Spots	30,000	$1,500	30,600	$1,520
Bream and sunfish	247,370	13,979	251,970	14,297	Striped bass	54,000	2,940	49,950	3,050
Buffalo-fish	1,170,000	22,750	1,168,000	22,695	Trout	567,500	28,665	579,820	29,508
Catfish	2,416,155	46,608	2,651,357	54,155	Miscellaneous fish	97,220	5,820	101,280	5,970
Channel bass	238,700	6,825	242,866	7,097	Shrimp	7,121,500	93,640	6,540,150	88,115
Croakers	125,500	6,510	129,367	6,725	Crayfish	138,000	6,900	140,650	7,030
Drum, fresh-water	11,000	810	18,200	1,352	Crabs, hard	817,800	12,180	842,400	12,255
Flounders	15,000	1,500	16,200	1,620	Crabs, soft	135,600	6,815	123,000	5,972
Mullet	283,166	7,775	284,300	7,900	Oysters	3,223,500	179,250	3,124,800	202,550
Pompano	24,150	3,108	26,550	3,493	Turtles	84,333	2,175	90,793	2,335
Rock bass	53,900	2,994	52,400	2,939	Terrapins	53,000	1,388	58,333	1,543
Sheepshead	341,625	23,280	351,867	23,728					
Silver perch	121,160	5,066	123,860	5,228	Total	17,557,249	497,277	17,194,133	526,946
Spanish mackerel	107,000	10,700	113,850	11,650					

Fisheries by apparatus.—Tables 63 and 64 exhibit by parishes the quantities and values of products taken with each of the principal forms of apparatus employed in the vessel and shore fisheries respectively.

Considering the vessel fisheries, it is seen that seines take the largest quantities of fish and yield the greatest money returns, the principal species thus secured being channel bass, trout, Spanish mackerel, and croakers. Lines are the only other means of capture for fish, and take only two species—red snapper and grouper. The average value of these fish per pound is much less than the catch of the seines, so that the relative difference between the products of the two forms of apparatus is much less than the value of the catch. The crustaceans enumerated in the table were also taken with seines, and the oysters were obtained with tongs.

In the shore fisheries, as in the vessel fisheries, seines are the most important means of capture, the output in 1890 being about 11,000,000 pounds of fish, crustaceans, and reptiles, having a value of over $230,000. Buffalo-fish, sheepshead, trout, catfish, and Spanish mackerel are the chief fish taken, while shrimp, crabs, terrapins, and turtles materially enhance the income of the seine fishermen. Lines are much more extensively used than in the vessel fisheries and secure a greater variety of fish, among which catfish and trout are especially important. The value of the line catch is about half that of the fish proper taken with seines. Such minor apparatus as cast nets and dip nets are mostly employed by semi-professional fishermen. The aggregate catch in 1890 was about 480,000 pounds, chiefly buffalo-fish, catfish, and trout, with a value of about $16,000. Tongs used in the oyster fishery and small traps employed in the capture of crayfish complete the list of apparatus in the shore fisheries.

63.—Table showing by parishes and apparatus the yield of the vessel fisheries of Louisiana in 1889 and 1890.

Apparatus and species.	Jefferson.				Orleans.				Plaquemines.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bluefish					12, 925	$776	13, 050	$843				
Bream and sunfish					14, 150	1, 158	18, 050	1, 385				
Buffalo-fish					10, 700	214	12, 250	245				
Catfish					21, 750	543	22, 650	571				
Channel bass					64, 900	3, 245	56, 450	2, 823				
Croakers					24, 050	2, 295	26, 800	2, 680				
Flounders					6, 450	645	7, 025	703				
Pompano					4, 850	729	5, 900	885				
Rock bass					1, 700	102	1, 800	108				
Sheepshead					14, 525	1, 387	14, 150	1, 340				
Silver perch					14, 500	870	16, 300	978				
Spanish mackerel					26, 700	2, 670	30, 150	3, 015				
Trout					21, 750	1, 716	21, 700	1, 682				
Miscellaneous fish					56, 000	3, 380	56, 000	3, 205				
Total					294, 950	19, 730	302, 275	20, 463				
Lines:												
Groupers					18, 500	185	17, 800	178				
Snappers, red					250, 400	7, 512	240, 500	7, 215				
Total					268, 900	7, 697	258, 300	7, 393				
Miscellaneous:												
Oysters	202, 881	$6, 801	158, 480	$5, 413	1, 996, 379	64, 210	2, 068, 017	66, 991	37, 765	$1, 400	29, 386	$1, 035
Shrimp					117, 000	2, 242	121, 900	2, 404				
Crabs, hard					24, 600	1, 640	8, 400	560				
Crabs, soft					11, 400	950	6, 900	575				
Total	202, 881	6, 801	158, 480	5, 413	2, 149, 379	69, 042	2, 205, 217	70, 530	37, 765	1, 400	29, 386	1, 035
Grand total	202, 881	6, 801	158, 480	5, 413	2, 614, 329	93, 672	2, 683, 492	96, 053	37, 765	1, 400	29, 386	1, 035

63.—Table showing the yield of the vessel fisheries of Louisiana in 1889 and 1890—Continued.

Apparatus and species.	Lafourche.				Terrebonne.				St. Mary.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Channel bass									10, 000	$290	40, 000	$1, 350
Croakers											2, 100	74
Flounders											2, 400	84
Mullet											3, 450	121
Sheepshead									8, 000	355	24, 800	838
Trout									30, 000	1, 060	54, 150	1, 836
Miscellaneous fish											4, 100	144
Total									48, 000	1, 705	131, 000	4, 447
Miscellaneous:												
Oysters	26, 600	$870	30, 184	$910	4, 200	$200	51, 590	$2, 508	357, 315	16, 326	428, 638	20, 489
Grand total	26, 600	870	30, 184	910	4, 200	200	51, 590	2, 508	405, 315	18, 031	559, 638	24, 936

SUMMARY.

Apparatus and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Seines:				
Bluefish	12,925	$776	13,050	$843
Bream and sunfish	14,150	1,158	18,050	1,385
Buffalo-fish	10,700	214	12,250	245
Catfish	21,750	543	22,650	571
Channel bass	74,900	3,535	96,450	4,173
Croakers	24,050	2,295	28,900	2,754
Flounders	6,450	645	9,425	787
Mullet			3,450	121
Pompano	4,850	729	5,900	885
Rock bass	1,700	102	1,800	108
Sheepshead	22,525	1,742	38,950	2,178
Silver perch	14,500	870	16,300	978
Spanish mackerel	26,700	2,670	30,150	3,015
Trout	51,750	2,776	75,850	3,518
Miscellaneous fish	56,000	3,380	60,100	3,349
Total	342,950	21,435	433,275	24,910
Lines:				
Groupers	18,500	$185	17,800	$178
Snappers, red	250,400	7,512	240,500	7,215
Total	268,900	7,697	258,300	7,393
Miscellaneous:				
Oysters	2,625,140	89,807	2,766,295	97,346
Shrimp	117,000	2,242	121,900	2,404
Crabs, hard	24,600	1,640	8,400	560
Crabs, soft	11,400	950	6,900	575
Total	2,778,140	94,639	2,903,495	100,885
Grand total	3,389,990	123,771	3,595,070	133,188

64.—Table showing by parishes and apparatus the yield of the shore fisheries of Louisiana in 1889 and 1890.

Apparatus and species.	St. Tammany.				Tangipahoa.				St. John Baptist.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Black bass	2, 800	$224	3, 000	$240	2, 100	$168	2, 200	$176	1, 300	$104	1, 500	$120
Bream and sunfish	7, 470	750	7, 700	766	5, 400	540	5, 650	558	10, 350	746	10, 500	756
Buffalo-fish	8, 500	170	8, 700	174	15, 700	314	16, 500	330	140, 000	2, 800	130, 500	2, 610
Catfish	36, 095	770	36, 500	775	17, 085	426	17, 500	430	74, 400	1. 860	75, 000	1, 868
Croakers	700	70	500	50	5, 500	550	3, 200	320	5, 550	550	5, 800	580
Mullet									10, 500	315	10, 500	315
Rock bass	1, 600	96	1, 450	87	1, 360	82	1, 420	84	4, 160	208	4. 100	246
Sheepshead	2, 290	229	2, 290	229	2, 485	249	2, 485	249	11, 900	1, 190	11, 900	1, 190
Striped bass	4, 100	205	3, 800	228	2, 125	111	2, 300	138	5, 500	275	5, 300	318
Trout	3, 200	250	3, 200	256	5, 100	408	5, 100	408	3, 000	240	3, 000	240
Miscellaneous fish	5, 200	422	5, 500	433	5, 500	440	5, 700	447	6, 250	500	6, 500	509
Total	71, 955	3, 186	72, 640	3, 238	62, 355	3, 288	62, 055	3, 140	272, 910	8. 788	264, 600	8, 752
Lines:												
Catfish	10, 480	225	11, 000	237	4, 900	124	5, 500	140	21, 600	540	22, 500	560
Mullet									2, 500	75	2, 500	75
Rock bass	400	24	400	24	340	20	380	23	1, 040	52	1, 000	60
Sheepshead	1, 310	131	1, 310	131	1, 415	141	1, 415	141	6, 600	660	6, 600	660
Striped bass	1, 100	55	1, 200	72	575	24	700	42	1, 400	70	1, 200	72
Trout	12, 075	845	12, 100	847	12, 250	857	12, 300	861	24, 325	1, 703	24, 450	1, 712
Miscellaneous fish	600	50	650	52	750	60	825	62	850	68	940	71
Total	25, 965	1, 330	26, 660	1, 363	20, 230	1. 226	21. 120	1, 269	58. 315	3, 168	59, 190	3, 210

64.—Table showing the yield of the shore fisheries of Louisiana in 1889 and 1890—Continued.

Apparatus and species.	St. Tammany.				Tangipahoa.				St. John Baptist.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Minor apparatus:												
Bream and sunfish	3,730	$370	3,500	$350	2,700	$270	2,900	$285	5,150	$372	5,250	$379
Catfish	5,825	125	6,500	140	2,755	70	3,500	82	12,000	300	13,550	320
Mullet									5,900	177	5,900	177
Trout	1,725	121	1,700	119	1,750	123	1,800	126	3,475	243	3,500	245
Miscellaneous fish	2,000	162	2,150	167	2,250	180	2,350	184	2,700	216	2,850	221
Total	13,280	778	13,850	776	9,455	643	10,550	677	29,225	1,308	31,050	1,342
Miscellaneous:												
Crayfish									26,200	1,300	26,500	1,325
Crabs, hard	1,000	66	1,000	67	1,500	100	1,500	100	2,000	134	1,700	113
Crabs, soft	8,000	400	7,500	375	7,600	380	7,200	360	10,000	500	9,800	490
Turtles	3,833	95	5,000	125	3,000	75	3,850	91	4,500	102	5,000	125
Total	12,833	561	13,500	567	12,100	555	12,550	551	42,700	2,036	43,000	2,053
Grand total	124,033	5,855	126,650	5,944	104,140	5,712	106,275	5,637	403,150	15,300	397,840	15,357

Apparatus and species.	St. Charles.				Jefferson.				Orleans.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Black bass	3,400	$272	3,500	$280	58,870	$2,403	58,920	$2,407	3,500	$280	3,850	$308
Bream and sunfish	8,270	415	8,500	430	64,000	2,557	64,170	2,569	16,570	1,475	17,575	1,545
Buffalo-fish	75,500	1,510	80,500	1,610	60,800	1,216	60,200	1,204	254,500	4,344	223,350	4,337
Catfish	52,350	1,170	52,500	1,172	25,835	639	26,000	642	112,578	2,794	114,578	2,825
Channel bass					108,000	2,240	109,150	2,718	10,200	510	11,000	550
Croakers	1,800	180	1,900	190	45,900	2,050	47,200	1,897	7,000	700	6,100	610
Drum, fresh-water											6,200	452
Flounders									5,000	500	5,200	520
Mullet	10,333	354	10,133	339	112,000	2,385	112,200	2,400	17,500	545	17,748	569
Pompano									9,650	1,223	10,850	1,415
Rock bass	4,000	240	3,950	237	3,200	192	3,050	183	3,200	192	6,750	370
Sheepshead	4,200	420	4,200	420	91,070	3,957	94,870	4,359	17,052	1,705	17,055	1,705
Silver perch					57,660	2,306	57,660	2,306	8,200	492	10,000	600
Spanish mackerel	8,850	885	3,850	385	4,300	430	9,300	930	31,110	3,111	33,665	3,466
Striped bass	2,500	125	2,750	165	3,050	153	3,300	198	6,800	340	6,500	406
Trout	4,100	342	4,150	332	207,800	10,470	208,000	10,490	2,300	180	3,100	248
Miscellaneous fish	3,050	245	3,500	262	4,800	384	4,950	389	9,000	585	9,400	600
Total	178,353	6,158	179,433	5,822	847,285	31,382	858,970	32,692	514,160	18,976	502,921	20,526
Lines:												
Bream and sunfish	4,000	120	4,000	120	10,000	300	10,000	300				
Catfish	35,200	640	38,500	700	142,500	2,212	166,500	3,200	20,200	518	22,480	537
Mullet	5,167	174	3,000	104	13,950	434	2,167	70	4,500	140	4,662	158
Rock bass	1,000	60	950	57	800	48	750	45	800	48	1,700	42
Sheepshead	2,300	230	2,300	230	2,330	233	2,330	233	9,748	975	9,745	975
Silver perch	2,000	60	2,000	60	5,000	150	5,000	150				
Spanish mackerel	1,950	195	950	95	900	90	1,900	190	5,890	589	6,500	674
Striped bass	600	30	750	45	750	37	700	42	1,700	85	1,500	94
Trout	20,125	1,409	20,140	1,410	16,800	1,176	16,800	1,176	29,750	2,082	30,230	2,105
Miscellaneous fish	385	30	450	32	600	48	680	51	1,100	70	1,200	74
Total	72,727	2,948	73,040	2,853	193,630	4,728	206,827	5,457	73,688	4,507	78,017	4,659
Minor apparatus:												
Bream and sunfish	4,130	205	4,250	213	3,170	125	3,225	129	1,780	177	2,390	227
Catfish	8,450	190	9,000	200	4,165	109	5,875	135	11,222	288	13,400	315
Mullet	11,100	385	5,000	185	27,901	867	6,100	200	9,500	297	9,800	329
Trout	2,875	201	2,900	203	2,400	168	2,400	168	4,250	298	4,730	321
Miscellaneous fish	1,165	93	1,200	94	1,800	144	1,850	146	3,600	241	3,800	248
Total	27,720	1,074	22,350	895	39,436	1,413	19,450	778	30,352	1,301	34,120	1,440
Miscellaneous:												
Shrimp					6,086,000	76,780	5,544,000	72,590	99,600	1,992	99,900	2,050
Crayfish	27,600	1,380	28,000	1,400	25,400	1,270	26,000	1,300	38,400	1,930	38,850	1,940
Crabs, hard	2,500	166	1,800	120	794,800	10,647	823,900	11,022	2,000	134	1,800	120
Crabs, soft	5,000	250	5,000	250	5,000	250	4,800	240	20,000	1,000	21,000	1,020
Oysters					630,000	31,000	604,800	39,300				
Turtles	1,000	17	1,350	24	11,000	270	10,867	247	2,500	62	3,700	86
Terrapins	2,000	58	2,500	67	2,500	67	3,333	108				
Total	38,100	1,871	38,650	1,861	7,554,700	120,284	7,017,700	124,807	162,500	5,118	165,250	5,216
Grand total	316,900	12,051	313,473	11,431	8,635,051	157,807	8,102,947	165,734	780,700	29,902	780,308	31,841

64.—Table showing the yield of the shore fisheries of Louisiana in 1889 and 1890—Continued.

Apparatus and species.	St. Bernard.				Plaquemines.				Lafourche.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Black bass	8,100	$648	8,600	$688								
Bream and sunfish	31,170	2,668	32,635	2,765								
Buffalo-fish	355,000	7,846	405,250	8,105					5,000	$75	4,000	$60
Catfish	303,662	5,046	309,197	5,123								
Channel bass	20,500	1,025	20,200	1,010					20,000	650	20,650	568
Croakers	9,050	910	10,000	1,000					9,000	270	10,250	390
Drum, fresh-water	11,000	810	12,000	900								
Flounders	10,000	1,000	11,000	1,100								
Mullet	52,315	1,627	52,715	1,675								
Pompano	14,500	1,885	15,700	2,078								
Rock bass	25,600	1,385	21,200	1,144								
Sheepshead	66,773	6,160	66,800	6,140					16,000	680	17,864	715
Silver perch	20,300	1,218	21,200	1,272								
Spanish mackerel	45,425	4,542	48,350	4,947								
Spots	30,000	1,500	30,600	1,520								
Striped bass	19,025	1,143	15,950	983								
Trout	2,500	200	3,550	284					43,000	1,400	45,300	1,355
Miscellaneous fish	30,412	1,254	31,162	1,285								
Total	1,055,332	40,867	1,116,109	42,019					93,000	3,075	98,064	3,088
Lines:												
Bream and sunfish					6,000	$180	6,000	$180	4,000	120	4,000	120
Catfish	88,220	1,465	92,390	1,505	265,000	5,300	265,000	5,300	10,000	150	12,200	200
Mullet			13,950	434								
Rock bass	6,400	347	5,300	337								
Sheepshead	38,152	3,470	38,200	3,450								
Silver perch					3,000	90	3,000	90	2,000	60	2,000	60
Spanish mackerel	8,575	858	9,335	963								
Striped bass	4,775	287	4,000	247								
Trout	35,600	2,579	36,085	2,593								
Miscellaneous fish	3,800	157	4,000	164								
Total	185,522	9,163	203,260	9,693	274,000	5,570	274,000	5,570	16,000	330	18,000	380
Minor apparatus:												
Bream and sunfish	13,480	1,209	13,725	1,225								
Buffalo-fish					150,000	3,000	150,000	3,000				
Catfish	48,978	814	50,850	834								
Channel bass					23,000	800	23,650	650				
Croakers					9,000	270	9,667	367				
Mullet			27,925	870								
Sheepshead					14,000	520	15,753	631				
Trout	5,100	370	5,585	394	40,000	1,320	41,700	1,250				
Miscellaneous fish	11,408	471	11,623	479								
Total	78,966	2,864	109,708	3,802	236,000	5,910	240,770	5,898				
Miscellaneous:												
Shrimp	125,900	2,518	120,500	2,410	120,000	2,700	118,750	2,225	50,000	1,200	47,000	705
Crayfish	20,400	1,020	21,300	1,065								
Crabs, hard	14,000	933	10,700	713								
Crabs, soft	80,000	4,035	67,700	3,237								
Oysters					546,000	55,000	535,500	56,000	483,000	24,000	451,500	20,000
Turtles	7,500	154	9,066	212					3,000	150	3,000	150
Total	247,800	8,660	229,266	7,637	666,000	57,700	654,250	58,225	536,000	25,350	501,500	29,855
Grand total	1,567,620	61,554	1,658,343	63,151	1,176,000	69,180	1,169,020	69,693	645,000	28,755	617,564	33,323

Apparatus and species.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Buffalo-fish	40,000	$575	34,000	$500	65,000	$900	55,000	$765				
Channel bass	50,000	1,400	50,470	1,388	7,000	200	7,746	213				
Croakers	18,000	540	19,250	732	14,000	420	15,500	589				
Sheepshead	37,000	1,410	38,500	1,540	17,000	920	18,250	730				
Trout	80,000	1,580	82,125	2,215	4,000	100	5,875	150				
Total	225,000	5,505	224,345	6,375	107,000	2,540	102,371	2,447				
Lines:												
Bream and sunfish	16,000	480	16,000	480	10,000	300	10,000	300				
Catfish	20,000	350	23,500	375	555,680	10,363	658,127	14,860	230,640	$4,950	274,060	$6,110
Silver perch	8,000	240	8,000	240	5,000	150	5,000	150				
Total	44,000	1,070	47,500	1,095	570,680	10,813	673,127	15,310	230,640	4,950	274,060	6,110

64.—Table showing the yield of the shore fisheries of Louisiana in 1889 and 1890—Continued.

Apparatus and species.	Terrebonne.				St. Mary.				Assumption.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Miscellaneous:												
Shrimp	600,000	$8,000	575,000	$7,670	40,000	$450	35,000	$465	....	....	....	....
Oysters	1,113,000	49,000	1,081,500	56,000	420,000	19,000	420,000	19,000	....	....	....	....
Turtles	18,000	450	18,460	462	30,000	800	30,500	813	....	....	....	....
Terrapins	....	....	....	....	48,500	1,263	52,500	1,368	....	....	....	....
Total	1,731,000	57,450	1,674,960	66,132	538,500	21,513	538,000	21,646	....	....	....	....
Grand total	2,000,000	64,025	1,946,805	73,602	1,216,180	34,866	1,313,496	39,403	230.640	$4.950	274,060	$6,110

Apparatus and species.	Iberville.				St. Martin.				Iberia.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:												
Catfish	15,000	$280	17,500	$320	84,300	$1,530	89,500	$1,600	92,035	$1,560	98,850	$1,650

Apparatus and species.	Vermilion.				Cameron.				Calcasieu.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Lines:												
Bream and sunfish	8,000	$240	8,000	$240	12,000	$360	12,000	$360	....	....	....	....
Catfish	25,000	400	30,000	500	35,000	600	40,000	650	45,000	$800	50,000	$850
Silver perch	4,000	120	4,000	120	6,000	180	6,000	180	....	....	....	....
Total	37,000	760	42,000	860	53,000	1,140	58,000	1,190	45,000	800	50,000	850
Miscellaneous:												
Oysters	6,300	250	6,300	250	25,200	1,000	25,200	1,000	....	....	....	....
Grand total	43,300	1,010	48,300	1,110	78,200	2,140	83,200	2,190	45,000	800	50,000	850

SUMMARY.

Apparatus and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Seines:				
Black bass	80,070	$4,099	81,570	$4,219
Bream and sunfish	143,230	9,151	146,730	9,389
Buffalo-fish	1,020,000	19,750	1,018,000	19,695
Catfish	622,005	12,705	631,275	12,835
Channel bass	215,700	6,025	219,216	6,447
Croakers	116,500	6,240	119,700	6,358
Drum, fresh-water	11,000	810	18,200	1,352
Flounders	15,000	1,500	16,200	1,620
Mullet	202,648	5,226	203,296	5,298
Pompano	24,150	3,108	26,550	3,493
Rock bass	43,120	2,395	41,920	2,351
Sheepshead	265,770	16,920	274,214	17,277
Silver perch	86,160	4,016	88,800	4,178
Spanish mackerel	89,685	8,968	95,165	9,728
Spots	30,000	1,500	30,600	1,520
Striped bass	43,100	2,352	39,900	2,436
Trout	355,000	15,170	363,400	15,978
Miscellaneous fish	64,212	3,830	66,712	3,925
Total	3,427,350	123,765	3,481,508	128,099
Lines:				
Bream and sunfish	70,000	2,100	70,000	2,100
Catfish	1,700,755	32,007	1,917,407	39,294
Mullet	26,117	823	26,279	841
Rock bass	10,780	599	10,480	588
Sheepshead	61,855	5,840	61,900	5,820
Silver perch	35,000	1,050	35,000	1,050
Spanish mackerel	17,315	1,732	18,685	1,922
Striped bass	10,900	588	10,050	614
Lines—continued:				
Trout	150,925	$10,651	152,105	$10,704
Miscellaneous fish	8,085	483	8,745	506
Total	2,091,732	55,873	2,310,651	63,439
Minor apparatus:				
Bream and sunfish	34,140	2,728	35,240	2,808
Buffalo-fish	150,000	3,000	150,000	3,000
Catfish	93,395	1,896	102,675	2,026
Channel bass	23,000	800	23,650	650
Croakers	9,000	270	9,667	367
Mullet	54,401	1,726	54,725	1,761
Sheepshead	14,000	520	15,753	631
Trout	61,575	2,844	64,315	2,826
Miscellaneous fish	24,923	1,507	25,823	1,539
Total	464,434	15,291	481,848	15,608
Miscellaneous:				
Shrimp	7,121,500	93,640	6,540,150	88,115
Crayfish	138.000	6,900	140.650	7,030
Crabs, hard	817,800	12,180	842,400	12,255
Crabs, soft	135,600	6,815	123,000	5,972
Oysters	3,223,500	179,250	3,124,800	202,550
Turtles	84,333	2.175	90,793	2,335
Terrapins	53,000	1,388	58,333	1,543
Total	11,573,733	302,348	10,920,126	319,800
Grand total	17,557,249	497,277	17,194,133	526,946

The shore industries.—The shore fishery industries of Louisiana are extensive. They comprise the wholesale handling of fresh fish and oysters, the drying of shrimp and fish, and the canning of oysters and shrimp. In the two following tables figures for these trades are given; in order to avoid the exhibition of private business interests, it has been necessary to present the information in a more condensed form than would otherwise be done.

Table 65 shows the extent of the fresh-oyster trade and the canned oyster and shrimp industry. The twelve firms engaged in 1890 employed 335 persons, to whom $67,900 was paid in wages. The amount invested in the business was $212,950. The total quantity of oysters handled was 189,895 barrels, the cost price of which was $250,701. From this amount 287,336 cans were prepared, for which $34,699 was received, and the remaining portion was sold fresh for $342,164, giving $126,162 as the gross profits of the oyster trade. From the 1,153,469 pounds of shrimp handled, 447,738 cans were prepared, the difference between the buying and selling being $42,934. The total value of the oysters and shrimp after passing through the hands of the dealers was $454,401, which was $169,096 in excess of the price paid, the latter sum therefore representing the gross profits.

The principal features of the wholesale trades in fish and shrimps are given in Table 66. Of the 9,592,230 pounds of products handled in 1889, 2,936,000 pounds, valued at $23,885, were shrimps; and of the 9,847,847 pounds handled in 1890, 2,456,000 pounds, worth $19,905, were shrimps. These were dried and sent to San Francisco for the Chinese trade. In 1889 the dried shrimp had a weight of 346,000 pounds, valued at $73,658, and in 1890, 293,600 pounds, worth $62,042. There is also a small business done in drying such fish as trout, redfish, sheepshead, and pompano, the quantity so utilized being 98,875 pounds in 1889 and 95,400 pounds in 1890, the cost value being $989 and $954, respectively. The resulting quantities of dried fish were 34,500 pounds, worth $4,240, in 1889, and 32,160 pounds, valued at $3,860, in 1890.

65.—Table showing the extent of the wholesale oyster trade and the canning of oysters and shrimp in Louisiana in 1889 and 1890.

Designation.	1889.	1890.	Designation.	1889.	1890.
Number of firms	12	12	Oysters, cans prepared.....number..	492, 102	287, 336
Number of employés	330	335	Value received	$52, 930	$34, 699
Value of property	$104, 000	$108, 750	Shrimp handled.............pounds..	951, 738	1, 153, 469
Cash capital	$103, 000	$104, 200	Value paid	$28, 285	$34, 604
Wages paid	$74, 380	$67, 900	Cans prepared...........number..	376, 672	447, 738
Oysters handled............barrels..	216, 345	189, 895	Value received	$65, 843	$77, 538
Value paid	$231, 323	$250, 701	Enhancement in value of products	$181, 562	$169, 096
Value of oysters sold fresh	$322, 397	$342, 164			

66.—Table showing the extent of the wholesale fresh-fish and shrimp trades of Louisiana in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	18	18
Number of employés	120	125
Value of property	$113, 400	$116, 325
Cash capital	$73, 300	$78, 300
Wages paid	$36, 672	$37, 264
Products handled.....................pounds..	9, 592, 230	9, 847, 847
Value paid	$334, 533	$363, 626
Value received	$518, 532	$550, 591
Enhancement in value	$183, 999	$186, 965

VI.—FISHERIES OF TEXAS.

Geography of the coast.—The coast of Texas presents features differing from any other of the Gulf States. Almost throughout its entire length it is bordered by a series of low, sandy islands and peninsulas, the Gulf side of which forms a very regular shore line, which, beginning at Sabine Lake, extends in a southwesterly direction to Corpus Christi, and thence in a southerly direction to the Rio Grande. Numerous bays occur between the mainland and the islands, the most important being Galveston, Matagorda, Espiritu Santo, Aransas, Corpus Christi, and Laguna Madre. The approximate length of the coast line of the State, including the indentations, is 2,010 miles. Besides the Sabine and Rio Grande, which streams form the coastal boundaries of the State, there are other important rivers which enter the Gulf of Mexico on the shores of Texas. The largest of these are the Neches, Trinity, Brazos, Colorado, Guadalupe, and Nueces.

The principal cities and towns along the coast are Sabine City, Galveston, Matagorda, Saluria, Port Lavaca, Rockport, and Corpus Christi. The islands and peninsulas which skirt the shores are, as a rule, unpopulated, the only noticeable exceptions being Galveston Island, on which the city of Galveston is located, and Bolivar Peninsula, which contains a few hundred people. On the shores of all the bays there are a few settlements of cattle-raisers, fishermen, etc., but it is only in Galveston, Matagorda, Aransas, and Corpus Christi bays that the population is large enough and the transportation facilities sufficiently good to support important fisheries.

Importance of the Texas fisheries.—The rank of Texas among the Gulf States is fourth in the item of persons engaged, fourth in the amount of capital invested, and third in the value of the products. As shown in Section I of this report, the development of the fishing industry in this State since 1880 has been phenomenally large, the number of fishermen and shoresmen having increased 112.48 per cent, the capital 652.05 per cent, and the value of the catch 143.05 per cent.

The only fishery products which are of actual or relative importance are three fish (trout, redfish, and sheepshead) and oysters, the value of which is more than four-fifths the total yield of the State. The fisheries for these and other species are capable of great development, as the natural fishery resources of the Texas coast are fully as favorable as those of any other Gulf State. The possibilities of the region for oyster-production and oyster-culture are beyond present calculation. The chief disadvantages with which the fishing interests now contend are the poor facilities for transportation.

Condensed statistics.—Four tables are first presented, which show, in a general way, the extent of the commercial fisheries of the coastal waters in 1889 and 1890.

From the first table it will be seen that 1,277 persons found employment in connection with the fisheries in 1890, of whom 84 were engaged on vessels, 1,032 in the boat or shore fisheries, and 161 in the shore industries related to or dependent on the fishing business.

The different nationalities represented in the Texas fisheries are shown in Table 68. The great preponderance of white Americans is noteworthy, and strongly contrasts with Louisiana. The number of colored fishermen is small as compared with other States of this section. The largest foreign element is from the countries of southern Europe, chiefly Italy, Spain, and Portugal.

The third table of the series gives the number and value of vessels, boats, and apparatus used, and the value of the shore property and cash capital required. Only 19 vessels were employed in 1890, a much smaller number than is found in any other Gulf State. The value of these and their outfits was $29,710. The 814 boats engaged in fishing had a value of $101,570; many of these are rigged craft, but, being under 5 tons burden, and not documented, are properly classed as boats. The apparatus of of capture had a value of $23,951, three-fourths of which sum was invested in seines. The shore property and cash or working capital amounted to $163,891. The total investment in 1890 was $319,122, an increase of $62,691 over the previous year.

The product of the Texan fisheries in 1889 was 7,357,800 pounds, valued at $297,258; and in 1890, 7,959,400 pounds, worth $313,832; the increase being chiefly due to the augmented output of oysters, which are the principal object of fishery. More than two-fifths the value of the catch represented oysters. Trout, channel bass, and sheepshead together were worth nearly as much as oysters. Over 1,000,000 pounds of each of the two first-named fish and nearly 800,000 pounds of the last were taken, the catch of these species being larger than in any other State.

67.—Table of persons employed.

How engaged.	1889.	1890.
On vessels fishing	59	73
On vessels transporting		11
In shore fisheries	1,017	1,032
On shore, in fish-houses, etc	135	161
Total	1,211	1,277

68.—Table showing the nationality of persons engaged in the fisheries.

Nationalities.	Vessel fishermen.		Shore fishermen.		Shoresmen.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
American, white	49	73	880	890	124	148	1,053	1,111
American, colored			30	30			30	30
Italian, Spanish, and Portuguese	5	5	56	58	2	3	63	66
German	1	2	4	4			5	6
Mexican			13	12	3	3	16	15
Norwegian and Swedish			2	3			2	3
Others	4	4	32	35	6	7	42	46
Total	59	84	1,017	1,032	135	161	1,211	1,277

69.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	15	$8,885	18	$10,705
Tonnage	132.69		152.59	
Outfit		2,400		3,005
Vessels transporting			1	15,000
Tonnage			88.17	
Outfit				1,000
Boats	803	99,945	814	101,570
Apparatus of capture—vessel fisheries:				
Seines	11	1,650	14	2,100
Turtle nets	20	200	20	200
Tongs	13	85	14	91
Apparatus of capture—shore fisheries:				
Seines	119	$14,330	122	$14,750
Turtle nets	182	1,830	186	1,872
Cast nets	303	1,028	315	1,070
Lines		570		540
Tongs	373	2,449	383	2,515
Miscellaneous		818		813
Shore property		82,741		110,391
Cash capital		39,500		53,500
Total		256,431		319,122

70.—*Table of products.*

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Bluefish	23,250	$1,[illegible]	25,700	$1,[illegible]
Bream and sunfish	24,225	1,255	34,700	1,735
Buffalo-fish	15,000	750	12,400	600
Catfish	37,700	1,600	45,000	2,000
Channel bass	1,069,325	46,300	1,107,150	47,365
Cavalla	51,975	1,494	56,250	2,241
Croakers	144,450	4,257	175,950	4,730
Drum, salt-water	4,000	40	4,000	40
Flounders	139,375	5,578	130,450	5,425
Jewfish	62,095	1,655	48,000	1,474
Mullet	81,400	2,000	83,450	2,770
Pike	31,810	1,405	32,450	1,402
Pompano	2,300	475	2,000	400
Sailor's choice	36,750	1,050	25,450	1,204
Sheepshead	738,739	28,420	778,400	30,471
Shoemaker	12,395	533	12,300	513
Snappers, red	22,000	1,250	4,400	240
Spanish mackerel	18,200	342	25,000	1,313
Striped bass	9,678	638	9,000	391
Trout	1,077,102	45,263	1,130,450	47,864
Miscellaneous fish	175,100	6,530	184,000	6,744
Oysters	*2,524,200	111,400	†3,085,600	127,900
Crabs	149,400	5,030	190,800	5,085
Shrimp	241,500	7,566	175,800	5,670
Terrapins	34,710	4,045	6,200	1,532
Turtles	572,200	9,168	583,000	9,345
Total	7,387,800	207,258	7,960,400	313,882

*360,600 bushels. †440,800 bushels.

Fisheries by counties.—There are ten counties in Texas, abutting on the Gulf of Mexico or on the bays or other indentations, which are interested in the commercial fisheries. These, in their geographical order, beginning on the east, are Jefferson, Chambers, Galveston, Brazoria, Matagorda, Calhoun, Refugio, Aransas, Nueces, and Cameron. In the three following tables the extent of the fishing industry in each county is shown. The prominent position occupied by Galveston, Aransas, and Nueces counties, in which are the towns of Galveston, Rockport, and Corpus Christi, is one of the most noteworthy exhibitions made by the tables. Under the heads "Fisheries by apparatus" and "The vessel and shore fisheries" additional features of the county fisheries are shown.

71.—*Table showing by counties the number of persons employed in the fisheries of Texas in 1889 and 1890.*

Counties.	In vessel fisheries.		In shore fisheries.		On shore.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Jefferson			31	34		....	31	34
Chambers			59	59	....	....	59	59
Galveston	7	18	450	447	66	85	523	550
Brazoria			74	74	....	....	74	74
Matagorda			63	66	....	....	63	66
Calhoun			62	65	8	8	70	73
Refugio			20	20		....	20	20
Aransas	19	27	119	122	37	41	175	190
Nueces	33	39	105	111	22	25	160	175
Cameron			34	34	2	2	36	36
Total	59	84	1,017	1,032	135	161	1,211	1,277

72.—Table showing by counties the apparatus and capital employed in the fisheries of Texas in 1889 and 1890.

Designation.	Jefferson.				Chambers.				Galveston.				Brazoria.			
	1889.		1890.		1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing									2	$735	2	$680				
Tonnage									12.93		12.93					
Outfit										330		330				
Vessels transporting											1	15,000				
Tonnage											88.17					
Outfit												1,000				
Boats	10	$400	10	$400	58	$6,635	58	$6,635	452	51,440	450	51,360	73	$8,295	73	$8,295
Apparatus of capture, vessel fisheries:																
Seines									2	300	2	300				
Apparatus of capture, shore fisheries:																
Seines	2	200	2	200	8	875	8	875	61	6,800	62	6,925	10	1,100	10	1,100
Cast nets	27	35	30	95	9	35	9	35	74	275	74	275	12	45	12	45
Lines		70		70		30		30		235		235		35		35
Tongs					24	160	24	160	188	1,250	186	1,240	30	202	30	200
Miscellaneous						75		75		600		600		100		100
Shore property		56		61						50,600		65,700				
Cash capital										20,000		30,000				
Total		811		826		7,810		7,810		132,565		173,645		9,777		9,775

Designation.	Matagorda.				Calhoun.				Refugio.				Aransas.			
	1889.		1890.		1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing													4	$2,600	6	$3,725
Tonnage													43.88		60.62	
Outfit														975		1,340
Boats	49	$6.875	51	$7.800	38	$6,775	40	$6,690	12	$2,135	12	$2,350	60	11,655	64	11.065
Apparatus of capture—vessel fisheries:																
Seines													4	600	6	900
Turtle nets													20	200	20	200
Apparatus of capture—shore fisheries:																
Seines	3	300	3	300	2	200	2	200	3	450	3	450	18	2.705	20	3,000
Turtle nets									25	250	25	250	150	1,500	155	1,550
Cast nets	15	50	15	50	15	50	15	50	7	25	8	29	38	135	42	151
Lines		5		5		5		5		10		5		50		25
Tongs	39	254	42	273	39	253	42	273	4	25	4	25	25	150	25	150
Miscellaneous, including spears										5		5		25		20
Shore property						1,050		1,050						12.910		25,440
Cash capital						1,500		1.500						6,000		10,000
Total		7,484		8,428		9,833		9,768		2,900		3,114		39,505		57,566

Designation.	Nueces.				Cameron.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	9	$5,550	10	$6,300					15	$8,885	18	$10,705
Tonnage	75.88		79.04						132.69		152.59	
Outfit		1,095		1,335						2.400		3,005
Vessels transporting											1	15,000
Tonnage											88.17	
Outfit												1,000
Boats	34	4,570	39	5,830	17	$1,165	17	$1,145	803	99,945	814	101,570
Apparatus of capture—vessel fisheries:												
Seines	5	750	6	900					11	1,650	14	2,100
Turtle nets									20	200	20	200
Tongs	13	85	14	91					13	85	14	91
Apparatus of capture—shore fisheries:												
Seines	10	1,500	10	1,500	2	200	2	200	119	14,330	122	14,750
Turtle nets					7	80	6	72	182	1,830	186	1,872
Cast nets	85	265	90	280	21	63	20	60	303	1,028	315	1,070
Lines		30		30		100		100		570		540
Tongs	20	130	26	169	4	25	4	25	373	2,449	383	2,515
Miscellaneous, including spears		10		10		3		3		818		813
Shore property		17,610		17,620		515		520		82,741		110,391
Cash capital		12,000		12,000						39,500		53,500
Total		43,595		46,065		2,151		2,125		256.431		319,122

73.—Table showing by counties and species the yield of the fisheries of Texas in 1889 and 1890.

Species.	Jefferson.				Chambers.				Galveston.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish					1.550	$102	1.400	$94	12.012	$787	10.800	$726
Bream and sunfish	1.000	$50	1.000	$50	2.270	116	2.150	108	17.595	904	16.663	637
Buffalo-fish	15.000	750	13.800	690								
Catfish	14.500	700	12.500	615	750	22	750	23	5.810	173	5.807	174
Channel bass	8,000	465	9.000	495	40.650	2,015	40.420	2.109	340.840	16.963	333.055	17.512
Crevalle					2.410	96	2.345	110	19.690	776	18.605	800
Croakers	2.000	100	2.000	100	6.875	318	7.000	357	48.007	2.901	56.115	2.809
Drum, salt-water					400	8	400	8	3.100	62	3.100	62
Flounders					4,700	255	4.600	260	39.100	2.025	37.975	2.075
Jewfish					750	30	650	30	5.800	232	5.035	232
Mullet					4.200	151	3.930	157	34.550	1.210	33.158	1.271
Pike	800	40	800	40	2.100	105	2.040	100	16.275	789	15.810	775
Pompano					250	67	200	60	1.950	524	1.550	465
Sailor's choice					1.835	72	1.700	85	14.215	562	13.175	659
Sheepshead	6.500	305	7.000	330	31.490	1,879	30.240	1.465	258,548	11.366	246.260	11,678
Shoemaker					830	41	780	38	6.070	322	6.045	294
Snappers, red					2.200	125	480	24	17.050	969	3.720	186
Spanish mackerel					600	42	1.000	60	4.650	325	7.750	465
Striped bass					620	31	500	25	4.805	239	3.875	193
Trout	9.700	490	10.700	540	44.900	2.320	42.735	2.282	368.943	19.153	351.046	18,827
Miscellaneous fish	11,800	505	12.200	528	5.190	234	5.300	244	41.223	1.844	42.075	1.926
Oysters					147.000	7.040	164.710	7.210	1,139,250	55.280	1,276,490	55.330
Crabs					16.500	420	16.250	430	127.900	3.250	125.937	3.255
Shrimp					20.250	634	13.800	451	156,940	4.918	106.950	3,495
Terrapins	2.450	580	2.700	650	3,120	520	240	60	24.180	4.030	1.860	465
Total	71,750	3.985	71,700	4.038	340.940	16.143	343.580	15,780	2,708,503	129.624	2,722,856	124,801

Species.	Brazoria.				Matagorda.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish	1,938	$126	1,800	$120					400	$16	500	$20
Bream and sunfish	2,835	145	2,687	135	330	$10	400	$12	670	20	800	24
Catfish	940	30	943	28								
Channel bass	50,810	2,502	50,525	2,524	9,635	350	10,715	382	19,365	700	21,435	765
Crevalle	3,000	120	2,800	140	450	15	500	16	900	25	1.000	29
Croakers	7.968	398	8,825	446	1,500	52	1,583	55	3.000	105	3,167	111
Drum, salt-water	500	10	500	10								
Flounders	6,000	340	5,125	325	1,350	55	1,983	79	2,650	105	3,967	159
Jewfish	950	38	815	38								
Mullet	5,250	189	4,862	197	2,835	83	2,830	82	5,665	167	5.670	168
Pike	2,625	156	2,550	125	300	11	335	12	600	20	665	23
Pompano	300	84	250	75								
Sailor's choice	2,300	90	2,125	106	335	14	370	15	665	26	730	29
Sheepshead	36,862	1,651	37,800	1,831	5,885	203	6,600	233	11,765	417	13,200	466
Shoemaker	1,400	52	975	48								
Snappers, red	2,750	156	600	30								
Spanish mackerel	750	53	1,250	75	270	16	330	18	530	30	670	37
Striped bass	775	40	625	32								
Trout	56,157	2,900	53,419	2,854	11,550	419	13,065	472	23,150	843	26,135	945
Miscellaneous fish	6,487	283	6,625	305	3,025	91	3,400	103	6,975	187	6,700	208
Oysters	183,750	8,080	205,900	9,600	307,300	13,200	510,300	19,470	153,650	6,600	255,150	9,730
Crabs	20,000	530	20,313	525								
Shrimps	25,310	793	17,250	564	340	10	340	10	660	20	660	20
Terrapins	3,900	650	300	75								
Total	424,157	19,426	428,864	20,208	345,105	14,529	552,751	20,959	229,645	9,281	340,449	12,734

73.—Table showing by counties and species the yield of the fisheries of Texas in 1889 and 1890—Continued.

Species.	Refugio.				Aransas.				Nueces.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish	643	$20	786	$26	5, 357	$168	7, 214	$236	2, 050	$82	3, 000	$105
Bream and sunfish	514	18	575	20	4, 286	150	5, 425	190	3, 725	112	4, 000	120
Catfish	7, 430	280	....	....	44, 570	1, 680	....	....	....	....	....	....
Channel bass	41, 715	1, 598	42, 142	1, 618	321, 285	12, 300	362, 858	13, 732	221, 025	7, 996	227, 800	8, 403
Crevalle	1, 643	57	2, 000	70	13, 457	469	18, 000	630	9, 425	296	10, 000	320
Croakers	4, 286	126	5, 286	157	35, 314	1, 062	47, 714	1, 403	38, 000	1, 125	42, 000	1, 215
Flounders	6, 710	263	7, 374	287	42, 190	1, 636	50, 626	1, 910	15, 275	610	16, 000	640
Jewfish	3, 872	153	4, 630	182	23, 788	946	28, 870	1, 132	6, 875	256	7, 000	260
Mullet	1. 686	46	1. 856	50	11, 314	298	13, 144	340	12, 300	336	14, 000	385
Pike	428	15	485	17	3, 532	120	4. 515	153	4. 150	125	4, 500	135
Sailor's choice	....	....	....	....	....	....	....	....	6, 650	265	7, 000	280
Sheepshead	26, 803	881	28, 557	969	205, 317	6, 750	245, 443	8, 083	148, 550	5, 207	157, 200	5, 356
Shoemaker	300	9	300	9	2, 240	66	2, 700	79	1, 425	43	1, 500	45
Spanish mackerel	714	29	900	35	5, 966	237	8, 100	323	3, 350	210	5, 000	300
Striped bass	285	10	300	10	2, 255	78	2, 700	93	938	38	1, 000	38
Trout	39, 370	1, 357	40. 588	1, 390	297, 070	10, 534	344, 912	12, 166	212, 262	7, 412	223, 750	7, 858
Miscellaneous fish	4, 429	136	4, 750	147	31. 971	1, 007	37, 250	1, 108	46, 000	1, 523	45, 200	1, 415
Oysters	26, 400	943	26. 550	943	158, 400	5. 657	159, 300	5, 657	379, 050	12, 900	457, 800	18, 350
Crabs	1, 714	57	1, 886	63	10, 286	343	11, 314	377	9. 400	380	11, 800	400
Terrapins	126.	31	114	29	934	234	986	253	....	....	....	....
Turtles	62, 771	1, 045	64, 571	1, 078	459, 429	7, 681	470, 429	7, 857	....	....	....	....
Total	231, 839	7, 074	233, 650	7, 100	1,678,961	51, 416	1,821,500	55, 722	1,120,450	38, 916	1,238,550	45, 625

Species.	Cameron.				Total for the State.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish	....	....	....	....	23, 950	$1, 301	25, 500	$1, 327
Bream and sunfish	1, 000	$30	1, 000	$30	34, 225	1, 555	34, 700	1, 526
Buffalo-fish	....	....	....	....	15, 000	750	13, 800	690
Catfish	23, 500	1, 175	25, 000	1, 250	97, 500	4, 060	45, 000	2, 090
Channel bass	10, 000	400	9, 000	365	1, 063, 325	45, 309	1, 107, 950	47, 905
Crevalle	1, 000	30	1, 200	36	51, 975	1, 884	56, 350	2, 241
Croakers	2, 000	70	2, 200	77	148, 450	6, 257	175, 950	6, 730
Drum, salt-water	....	....	....	....	4, 000	80	4, 000	80
Flounders	3, 000	90	3, 000	90	120, 975	5, 379	130, 650	5, 825
Jewfish	....	....	....	....	42, 035	1, 655	46, 000	1, 874
Mullet	4, 000	120	4. 000	120	81, 800	2, 600	83, 450	2, 770
Pike	800	24	750	22	31, 610	1, 405	32, 450	1, 402
Pompano	....	....	....	....	2, 500	675	2, 000	600
Sailor's choice	750	30	750	30	26, 750	1, 059	25, 850	1, 204
Sheepshead	7, 000	280	6, 500	260	738, 720	28, 439	778, 800	30, 871
Shoemaker	....	....	....	....	12, 265	533	12, 300	513
Snappers, red	....	....	....	....	22, 000	1, 250	4, 800	240
Spanish mackerel	....	....	....	....	16, 830	942	25, 000	1, 313
Striped bass	....	....	....	....	9, 678	436	9, 000	391
Trout	14, 000	535	14. 100	530	1, 077, 102	45, 963	1, 120, 450	47, 864
Miscellaneous fish	19. 000	710	20, 500	760	175, 100	6, 530	184. 000	6, 744
Oysters	29. 400	1, 700	29, 400	1, 700	2, 524. 200	111, 400	3, 085. 600	127, 990
Crabs	3. 000	50	3, 300	55	189. 400	5, 030	190. 800	5, 095
Shrimp	38, 000	1, 180	36, 800	1, 130	241, 500	7, 555	175. 800	5, 670
Terrapins	....	....	....	....	34, 710	6, 045	6, 200	1, 532
Turtles	50, 000	440	48, 000	410	572, 200	9, 166	583, 000	9, 345
Total	206, 450	6, 864	205, 500	6, 865	7, 357, 800	297, 258	7, 959, 400	313, 832

The vessel and shore fisheries.—The number of vessels employed in the fisheries of Texas is much less than in any other Gulf State, as shown in Table 2, although in 1890 the value of the products of the vessel fisheries surpassed that of Alabama. In the following table the yield by vessels is given; in 1890 this amounted to 984,100 pounds, valued at $34,227, consisting chiefly of channel bass, sheepshead, trout, and oysters, the first-named species being the most important single product.

The value of the shore fisheries is about eight times that of the vessel fisheries. The most important objects of capture are trout, channel bass, sheepshead, and oysters, the last being by far the most valuable.

The men and property devoted to the vessel and shore fisheries have been shown separately in previous tables; the exposition of the extent of each of these branches is therefore made complete by the presentation of Tables 74 and 75, which relate to the products. Under the caption "Fisheries by apparatus," certain other data are also given for the vessel and shore fisheries.

74.—Table showing by counties and species the yield of the vessel fisheries of Texas in 1889 and 1890.

Species.	Galveston.				Aransas.				Nueces.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish					1,500	$48	2,500	$80	800	$32	1,400	$49
Bream and sunfish					1,200	42	2,000	70	1,425	43	1,900	57
Channel bass	20,000	$1,000	19,800	$1,055	71,000	2,698	110,000	4,025	75,125	2,796	103,500	3,903
Crevalle	1,000	30	1,200	40	3,600	126	6,000	210	3,375	116	4,500	155
Croakers	1,000	30	1,400	40	9,600	288	16,000	460	15,000	435	20,000	580
Flounders	2,600	60	1,700	60	3,900	140	6,500	220	4,125	165	5,500	220
Jewfish					660	24	1,100	30	675	20	900	27
Mullet	2,000	40	2,650	53	1,200	24	2,000	40	1,050	16	1,400	21
Pike					960	30	1,600	50	1,650	50	2,200	66
Sailor's choice									2,250	90	3,000	120
Sheepshead	12,000	600	11,900	521	44,400	1,461	74,000	2,267	57,150	1,947	76,200	2,596
Shoemaker					540	15	900	25	525	16	700	21
Spanish mackerel					1,680	66	2,800	110	1,000	60	2,400	144
Striped bass					540	18	900	30	338	14	450	18
Trout	21,000	1,170	19,850	1,123	60,840	2,391	101,400	3,818	78,512	2,737	104,950	3,648
Miscellaneous fish	1,000	30	1,000	35	5,400	190	9,000	245	12,000	338	16,000	450
Oysters									145,950	5,425	159,600	6,080
Terrapins					180	45	300	75				
Turtles					82,800	1,409	83,000	1,390				
Total	60,000	2,900	59,500	2,927	290,000	9,015	420,000	13,145	400,950	14,300	504,600	18,155

SUMMARY.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Bluefish	2,300	$80	3,900	$129
Bream and sunfish	2,625	85	3,900	127
Channel bass	166,125	6,494	233,300	8,983
Crevalle	7,975	272	11,700	405
Croakers	25,600	753	37,400	1,080
Flounders	10,625	365	13,700	500
Jewfish	1,335	44	2,000	57
Mullet	4,250	80	6,050	114
Pike	2,610	80	3,800	116
Sailor's choice	2,250	90	3,000	120
Sheepshead	113,550	4,008	162,100	5,384
Shoemaker	1,065	$31	1,600	$46
Spanish mackerel	2,680	126	5,200	254
Striped bass	878	32	1,350	48
Trout	160,352	6,298	226,200	8,589
Miscellaneous fish	18,400	558	26,000	730
Oysters	145,950	5,425	159,600	6,080
Terrapins	180	45	300	75
Turtles	82,800	1,409	83,000	1,390
Total	751,550	26,275	984,100	34,227

75.—Table showing by counties and species the yield of the shore fisheries of Texas in 1889 and 1890.

Species.	Jefferson.				Chambers.				Galveston.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish					1,550	$102	1,400	$94	12,012	$787	10,800	$726
Bream and sunfish	1,000	$50	1,000	$50	2,270	116	2,150	108	17,595	904	16,663	837
Buffalo-fish	15,000	750	13,800	690								
Catfish	14,500	700	12,500	615	750	22	750	23	5,810	173	5,807	174
Channel bass	8,000	465	9,000	495	40,650	2,015	40,420	2,109	320,840	15,983	313.255	16,457
Crevalle					2,410	96	2,245	110	18,690	746	17,405	850
Croakers	2,000	100	2,000	100	6,375	318	7,060	357	47,007	2,871	54,715	2,769
Drum, salt-water					400	8	400	8	3,100	62	3,100	62
Flounders					4,700	255	4,600	260	36,500	1,965	36,275	2,015
Jewfish					750	30	650	30	5,800	232	5,035	232
Mullet					4,200	151	3,930	157	32,550	1,170	30,508	1,218
Pike	800	40	800	40	2,100	105	2,040	100	16,275	789	15,810	775
Pompano					250	67	200	60	1,950	524	1,550	465
Sailor's choice					1,835	72	1,700	85	14,215	562	13,175	659
Sheepshead	6,500	305	7,000	330	31,490	1,379	30,240	1,465	246,548	10,766	234,360	11,357
Shoemaker					830	41	780	38	6,070	322	6,045	294
Snappers, red					2,200	125	480	24	17,050	969	3,720	186
Spanish mackerel					600	42	1,000	60	4,650	325	7,750	465
Striped bass					620	31	500	25	4,805	239	3,875	193
Trout	9,700	490	10,700	540	44.900	2,320	42,735	2,282	347,943	17,983	331,196	17,704
Miscellaneous fish	11,800	505	12,200	528	5,190	234	5,300	244	40,223	1,814	41,075	1,891
Oysters					147.000	7,040	164,710	7,210	1,139,250	55,280	1,276,490	55,330
Crabs					16.500	420	16,250	420	127,200	3,250	125,937	3,255
Shrimp					20,250	634	13,800	451	156,940	4,918	106,950	3,495
Terrapins	2,450	580	2,700	650	3,120	520	240	60	24,180	4,030	1,860	465
Turtles												
Total	71,750	3,985	71,700	4,038	340,940	16,143	343,580	15,780	2,647,903	126,664	2,663,356	121,874

Species.	Brazoria.				Matagorda.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish	1,938	$126	1,800	$120					400	$16	500	$20
Bream and sunfish	2,835	145	2,687	135	330	$10	400	$12	670	20	800	24
Catfish	940	30	943	28								
Channel bass	50,810	2,502	50,525	2.524	9,635	350	10,715	382	19,365	700	21,435	765
Crevalle	3,000	120	2,800	140	450	15	500	16	900	25	1,000	29
Croakers	7,968	398	8,825	446	1,500	52	1,583	55	3,000	105	3,167	111
Drum, salt-water	500	10	500	10								
Flounders	6,000	340	5,125	325	1,350	55	1,983	79	2,650	105	3,967	159
Jewfish	950	38	815	38								
Mullet	5,250	189	4,862	197	2,835	83	2,830	82	5,665	167	5,670	168
Pike	2,625	156	2,550	125	300	11	335	12	600	20	665	23
Pompano	300	84	250	75								
Sailor's choice	2,300	90	2,125	106	335	14	370	15	665	26	730	29
Sheepshead	36,862	1.651	37,800	1.831	5,885	203	6,600	233	11,765	417	13,200	466
Shoemaker	1,400	52	975	48								
Snappers, red	2,750	156	600	30								
Spanish mackerel	750	53	1,250	75	270	16	330	18	530	30	670	37
Striped bass	775	40	625	32								
Trout	56,157	2,900	53,419	2.854	11,550	419	13,065	472	23.150	843	26,135	945
Miscellaneous fish	6,487	293	6,625	305	3,025	91	3,400	103	6,975	187	6,700	208
Oysters	183,750	8,080	205,900	9.600	307,300	13,200	510,300	19,470	153,650	6,600	255,150	9,730
Crabs	20,600	530	20,313	525								
Shrimp	25,310	793	17,250	564	340	10	340	10	660	20	660	20
Terrapins	3,900	650	300	75								
Turtles												
Total	424,157	19,426	428,864	20,208	345,105	14.529	552,751	20,959	229,645	9,281	340,449	12,734

75.—Table showing by counties and species the yield of the shore fisheries of Texas in 1889 and 1890—Continued.

Species.	Refugio.				Aransas.				Nueces.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish	643	$20	786	$26	3,857	$120	4,714	$156	1,250	$50	1,600	$56
Bream and sunfish	514	18	575	20	3,086	108	3,425	120	2,300	69	2,100	63
Catfish	7,430	280	....	....	44,570	1,680	....	....	....	....	....	....
Channel bass	41,715	1,598	42,142	1,618	250,285	9,602	252,858	9,707	145,900	5,200	124,300	4,500
Crevalle	1,643	57	2,000	70	9,857	343	12,000	420	6,050	180	5,500	165
Croakers	4,286	126	5,286	157	25,714	774	31,714	943	23,000	690	22,000	635
Flounders	6,710	263	7,374	287	38,290	1,496	44,126	1,690	11,150	445	10.500	420
Jewfish	3,872	153	4,630	182	23,128	922	27,770	1,102	6,200	236	6,100	233
Mullet	1,686	46	1,856	50	10,114	274	11,144	300	11,250	320	12,600	364
Pike	428	15	485	17	2,572	90	2,915	103	2,500	75	2,300	69
Sheepshead	....	....	....	....	....	....	....	....	4,400	175	4,000	160
Shoemaker	26,803	881	28,557	969	160,917	5,289	171,443	5,816	91,400	3,260	81,000	2,760
Spanish mackerel	300	9	300	9	1,700	51	1,800	54	900	27	800	24
Striped bass	714	29	900	35	4,286	171	5,300	213	2,350	150	2,600	156
Trout	285	10	300	10	1,715	60	1,800	63	600	24	550	20
Miscellaneous fish	39,370	1,357	40,588	1,390	236,230	8,143	243,512	8,348	133,750	4,675	118,800	4,210
Oysters	4,429	136	4,750	147	26,571	817	28,250	863	34,000	1,185	29,200	965
Crabs	26,400	943	26,550	943	158,400	5,657	159,300	5,657	233,100	7,475	298,200	12,270
Shrimp	1,714	57	1,886	63	10,286	343	11,314	377	9,400	380	11,800	400
Terrapins	126	31	114	29	754	189	686	178	....	....	....	....
Turtles	62,771	1,045	64,571	1,078	376,629	6,272	387,429	6,467	....	....	....	....
Total	231,839	7,074	233,650	7,100	1,388,961	42,401	1,401,500	42,577	719,500	24,616	733,950	27,470

Species.	Cameron.				Total.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish	....	....	....	....	21.650	$1,221	21,600	$1,198
Bream and sunfish	1,000	$30	1,000	$30	31,600	1,470	30,800	1,399
Buffalo-fish	....	....	....	....	15,000	750	13,800	690
Catfish	23,500	1,175	25,000	1,250	97,500	4,060	45,000	2,090
Channel bass	10,000	400	9,000	365	897.200	38,815	874,650	38,922
Crevalle	1,000	30	1,200	36	44,000	1,612	44.650	1,836
Croakers	2,000	70	2,200	77	122,850	5,504	138,550	5,650
Drum, salt-water	....	....	....	....	4,000	80	4,000	80
Flounders	3,000	90	3,000	90	110.350	5,014	116,950	5,325
Jewfish	....	....	....	....	40,700	1,611	44.000	1,817
Mullet	4,000	120	4,000	120	77.550	2,520	77,400	2,656
Pike	800	24	750	22	29.000	1,325	28,650	1,286
Pompano	....	....	....	....	2,500	675	2,000	600
Sailor's choice	750	30	750	30	24,500	969	22.850	1,084
Sheepshead	7,000	280	6,500	260	625,170	24,431	616,700	25,487
Shoemaker	....	....	....	....	11,200	502	10,700	467
Snappers, red	....	....	....	....	22,000	1,250	4,800	240
Spanish mackerel	....	....	....	....	14,150	816	19,800	1,059
Striped bass	....	....	....	....	8,800	404	7,650	343
Trout	14,000	535	14,100	530	916,750	39,665	894,250	39,275
Miscellaneous fish	19,000	710	20,500	760	156,700	5,972	158,000	6,014
Oysters	29,400	1,700	29,400	1,700	2,378,250	105,975	2,926,000	121,910
Crabs	3,000	50	3,300	55	189,400	5,030	190,800	5,095
Shrimp	38,000	1,180	36,800	1,130	241,500	7,555	175,800	5,670
Terrapins	....	....	....	....	34,530	6,000	5,900	1,457
Turtles	50,000	440	48,000	410	489,400	7,757	500,000	7,955
Total	206,450	6,864	205,500	6,865	6,606,250	270,983	6,975,300	279,605

The fisheries by apparatus.—In the vessel fisheries of Texas, the only kind of apparatus used in taking fish is the haul seine, which is also employed, in a modified form, in the capture of turtles. The only remaining product, the oyster, is obtained with tongs.

In the shore fisheries there is a greater variety of devices of capture, and the following tabular presentation, showing the importance of the different appliances, possesses interest. The haul seine, which seems to be well adapted to the waters of this region, takes larger quantities of fish than any other apparatus. In 1890, 2,818,900 pounds of fish, worth $122,293, were obtained in this way, besides shrimps, crabs, terrapins, and turtles. The principal species of fish caught are trout, channel bass, and sheepshead. Lines, in 1890, took 202,400 pounds of fish, valued at $8,595, besides a portion of the yield of crabs. The fish caught in largest quantities in this way were catfish, jewfish, channel bass, trout, and sheepshead. Cast nets are sparingly employed in the capture of shrimps and a limited number of species of fish, the most important of which is mullet. The aggregate yield of fish by this means in 1890 was only 88,500 pounds, having a value of $3,430. Spears are employed in a number of counties in obtaining flounders, of which 67,000 pounds were taken in 1890, for which the fishermen received $3,200.

76.—Table showing by counties and apparatus the yield of the shore fisheries of Texas in 1889 and 1890.

Apparatus and species.	Jefferson.				Chambers.				Galveston.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bluefish					750	$38	600	$30	5,812	$291	4,650	$232
Bream and sunfish	1,000	$50	1,000	$50	1,970	98	1,850	90	15,270	764	14,338	698
Buffalo-fish	15,000	750	13,800	690								
Catfish	6,000	300	5,500	275								
Channel bass	5,500	340	6,500	370	40,650	2,015	40,420	2,109	320,840	15,983	313,255	16,457
Crevalle					2,410	96	2,245	110	18,690	746	17,405	850
Croakers	2,000	100	2,000	100	6,375	318	7,060	357	47,007	2,871	54,715	2,769
Flounders					2,000	100	1,900	100	15,700	760	14,725	775
Jewfish					500	20	400	20	3,870	155	3,100	155
Mullet					1,700	51	1,430	57	13,175	395	11,083	444
Pike	800	40	800	40	2,100	105	2,040	100	16,275	789	15,810	775
Pompano					250	67	200	60	1,950	524	1,550	465
Sailor's choice					1,835	72	1,700	85	14,215	562	13,175	659
Sheepshead	4,500	225	5,000	250	31,000	1,355	29,500	1,431	242,750	10,575	228,625	11,089
Shoemaker					830	41	780	38	6,070	322	6,045	294
Spanish mackerel					600	42	1,000	60	4,650	325	7,750	465
Striped bass					620	31	500	25	4,805	239	3,875	193
Trout	6,500	330	7,500	380	44,600	2,299	42,435	2,262	345,618	17,820	328,871	17,540
Miscellaneous fish	2,000	80	2,200	88	5,190	234	5,300	244	40,223	1,814	41,075	1,891
Total	43,300	2,215	44,300	2,243	143,380	6,982	139,360	7,178	1,116,920	54,935	1,080,047	55,751
Cast nets:												
Bream and sunfish					300	18	300	18	2,325	140	2,325	139
Mullet					2,500	100	2,500	100	19,375	775	19,425	774
Miscellaneous fish	2,800	175	3,000	190								
Total	2,800	175	3,000	190	2,800	118	2,800	118	21,700	915	21,750	913
Lines:												
Bluefish					800	64	800	64	6,200	496	6,150	494
Catfish	8,500	400	7,000	340	750	22	750	23	5,810	173	5,807	174
Channel bass	2,500	125	2,500	125								
Drum, salt-water					400	8	400	8	3,100	62	3,100	62
Jewfish					250	10	250	10	1,930	77	1,935	77
Sheepshead	2,000	80	2,000	80	490	24	740	34	3,798	191	5,735	268
Snappers, red					2,200	125	480	24	17,050	969	3,720	186
Trout	3,200	160	3,200	160	300	21	300	20	2,325	163	2,325	164
Miscellaneous fish	7,000	250	7,000	250								
Total	23,200	1,015	21,700	955	5,190	274	3,720	183	40,213	2,131	28,772	1,425
Spears:												
Flounders					2,700	155	2,700	160	20,800	1,205	21,550	1,240
Miscellaneous:												
Oysters					147,000	7,040	164,710	7,210	1,139,250	55,280	1,276,490	55,330
Crabs					16,500	420	16,250	420	127,900	3,250	125,937	3,255
Shrimp					20,250	634	13,800	451	156,940	4,918	106,950	3,495
Terrapins	2,450	580	2,700	650	3,120	520	240	60	24,180	4,030	1,860	465
Turtles												
Total	2,450	580	2,700	650	186,870	8,614	195,000	8,141	1,448,270	67,478	1,511,237	62,545
Grand total	71,750	3,985	71,700	4,038	340,940	16,143	343,580	15,780	2,647,903	126,664	2,663,356	121,874

76.—Table showing by counties and apparatus the yield of the shore fisheries of Texas in 1889 and 1890—Cont'd.

Apparatus and species.	Brazoria.				Matagorda.				Calhoun.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bluefish	938	$46	750	$38					400	$16	500	$20
Bream and sunfish	2,460	123	2,312	112	330	$10	400	$12	670	20	800	24
Channel bass	50,810	2,502	50,525	2,524	8,300	292	9,500	327	16,700	583	19,000	655
Crevalle	3,000	120	2,800	140	450	15	500	16	900	25	1,000	29
Croakers	7,968	398	8,825	446	1,500	52	1,583	55	3,000	105	3,167	111
Flounders	2,500	150	2,375	125	1,350	55	1,983	79	2,650	105	3,967	159
Jewfish	630	25	500	25								
Mullet	2,125	64	1,787	71	335	8	330	7	665	17	670	18
Pike	2,625	156	2,550	125	300	11	335	12	600	20	665	23
Pompano	300	84	250	75								
Sailor's choice	2,300	90	2,125	106	335	14	370	15	665	26	730	29
Sheepshead	36,250	1,621	36,875	1,788	5,385	183	6,150	215	10,765	377	12,300	430
Shoemaker	1,400	52	975	48								
Spanish mackerel	750	53	1,250	75	270	16	330	18	530	30	670	37
Striped bass	775	40	625	32								
Trout	55,782	2,874	53,044	2,828	9,900	346	11,265	394	19,800	694	22,535	788
Miscellaneous fish	6,487	293	6,625	305	1,000	30	1,335	40	2,000	60	2,665	80
Total	177,100	8,691	174,193	8,863	29,455	1,032	34,081	1,190	59,345	2,078	68,669	2,403
Cast nets:												
Bream and sunfish	375	22	375	23								
Mullet	3,125	125	3,075	126	2,500	75	2,500	75	5,000	150	5,000	150
Trout					1,000	43	1,000	43	2,000	87	2,000	87
Miscellaneous fish					1,200	38	1,200	38	2,300	77	2,300	77
Total	3,500	147	3,450	149	4,700	156	4,700	156	9,300	314	9,300	314
Lines:												
Bluefish	1,000	80	1,050	82								
Catfish	940	30	943	28								
Channel bass					1,335	58	1,215	55	2,665	117	2,435	110
Drum, salt-water	500	10	500	10								
Jewfish	320	13	315	13								
Sheepshead	612	30	925	43	500	20	450	18	1,000	40	900	36
Snappers, red	2,750	156	600	30								
Trout	375	26	375	26	650	30	800	35	1,350	62	1,600	70
Miscellaneous fish					825	23	865	25	1,675	50	1,735	51
Total	6,497	345	4,708	232	3,310	131	3,330	133	6,690	269	6,670	267
Spears:												
Flounders	3,500	190	2,750	200								
Miscellaneous:												
Oysters	183,750	8,090	206,000	9,600	307,300	13,200	510,300	19,470	153,650	6,600	255,150	9,730
Crabs	21,000	530	20,313	525								
Shrimp	25,810	783	17,250	564	340	10	340	10	660	20	660	20
Terrapins	3,000	650	300	75								
Total	233,560	10,053	243,863	10,764	307,640	13,210	510,640	19,480	154,310	6,620	255,810	9,750
Grand total	424,157	19,426	428,964	20,208	345,105	14,529	552,751	20,959	229,645	9,281	340,449	12,734

76.—Table showing by counties and apparatus the yield of the shore fisheries of Texas in 1889 and 1890—Cont'd.

Apparatus and species.	Refugio.				Aransas.				Nueces.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bluefish	643	$20	786	$26	3,857	$120	4,714	$156	1,250	$50	1,000	$56
Bream and sunfish	514	18	575	20	3,086	108	3,425	120	2,300	69	2,100	63
Channel bass	39,715	1,528	39,857	1,536	238,285	9,172	239,143	9,214	137,900	4,880	116,300	4,180
Crevalle	1,643	57	2,000	70	9,857	343	12,000	420	6,050	180	5,500	165
Croakers	4,286	126	5,286	157	25,714	774	31,714	943	23,000	690	22,000	635
Flounders	1,710	63	2,214	77	10,290	376	13,286	460	7,150	285	6,500	260
Jewfish	300	10	345	12	1,700	65	2,055	72	1,200	36	1,100	33
Mullet	486	10	570	11	2,914	58	3,430	69	1,750	35	1,600	24
Pike	428	15	485	17	2,572	90	2,915	103	2,500	75	2,300	69
Sailor's choice									4,400	175	4,000	160
Sheepshead	26,103	856	27,700	937	156,617	5,134	166,300	5,623	88,400	3,140	78,000	2,640
Shoemaker	300	9	300	9	1,700	51	1,800	54	900	27	800	24
Spanish mackerel	714	29	900	35	4,286	171	5,300	213	2,350	150	2,600	156
Striped bass	285	10	300	10	1,715	60	1,800	63	600	24	550	20
Trout	37,715	1,289	38,728	1,312	226,285	7,736	232,372	7,876	127,250	4,380	112,000	3,900
Miscellaneous fish	2,857	86	3,000	90	17,143	514	18,000	540	23,000	730	18,000	505
Total	117,699	4,126	123,046	4,319	706,021	24,772	738,254	25,926	430,000	14,926	374,950	12,890
Cast nets:												
Mullet	1,200	36	1,286	39	7,200	216	7,714	231	9,500	285	11,000	340
Trout	370	18	430	21	2,230	107	2,570	129	3,500	175	3,800	190
Miscellaneous fish	572	26	600	27	3,428	157	3,400	153	5,000	215	5,200	220
Total	2,142	80	2,316	87	12,858	480	13,684	513	18,000	675	20,000	750
Lines:												
Catfish	7,430	280			44,570	1,680						
Channel bass	2,000	70	2,285	82	12,000	430	13,715	493	8,000	320	8,000	320
Jewfish	3,572	143	4.285	170	21,428	857	25,715	1,030	5,000	200	5,000	200
Sheepshead	700	25	857	32	4,300	155	5,143	193	3,000	120	3,000	120
Trout	1,285	50	1,430	57	7,715	300	8,570	343	3,000	120	3,000	120
Miscellaneous fish	1,000	24	1,150	30	6,000	146	6,850	170	6,000	240	6,000	240
Total	15,987	592	10,007	371	96,013	3,568	59,993	2,229	25,000	1,000	25,000	1,000
Spears:												
Flounders	5,000	200	5,160	210	28,000	1,120	30,840	1,230	4,000	160	4,000	160
Miscellaneous:												
Oysters	26,400	943	26,550	943	158,400	5,657	159,300	5,657	233,100	7,475	298,200	12,270
Crabs	1,714	57	1,886	63	10.286	343	11,314	377	9,400	380	11,800	400
Terrapins	126	31	114	29	754	189	686	178				
Turtles	62,771	1,045	64,571	1,078	376,629	6,272	387,429	6,467				
Total	91,011	2,076	93.121	2,113	546,069	12,461	558,729	12,679	242,500	7,855	310,000	12,670
Grand total	231,839	7,074	233,650	7,100	1,388,961	42,401	1,401,500	42,577	719,500	24,616	733,950	27,470

Apparatus and species.	Cameron.				Total.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Bluefish					13,650	$581	13,600	$558
Bream and sunfish	1,000	$30	1,000	$30	28,600	1,290	27,800	1,219
Buffalo-fish					15,000	750	13,800	690
Catfish					6,000	300	5,500	275
Channel bass	10,000	400	9,000	365	868,700	37,695	843,500	37,737
Crevalle	1,000	30	1,200	36	44,000	1,612	44,650	1,836
Croakers	2,000	70	2,200	77	122,850	5,504	138,550	5,650
Flounders	3,000	90	3,000	90	46,350	1,984	49,950	2,125
Jewfish					8,200	311	7,500	317
Mullet					23,150	638	20,900	701
Pike	800	24	750	22	29,000	1,325	28,650	1,286
Pompano					2,500	675	2,000	600
Sailor's choice	750	30	750	30	24,500	969	22,850	1,084
Sheepshead	7,000	280	6,500	260	608,770	23,746	596,950	24,663
Shoemaker					11,200	502	10,700	467
Spanish mackerel					14,150	816	19,800	1,059
Striped bass					8,800	404	7,650	343
Trout	12,500	475	12,600	470	885,950	38,243	861,350	37,750
Miscellaneous fish	5,000	150	5,000	150	104,900	3,991	103,200	3,933
Total	43,050	1,579	42,000	1,530	2,866,270	121,336	2,818,900	122,293

76.—Table showing by counties and apparatus the yield of the shore fisheries of Texas in 1889 and 1890—Cont'd.

Apparatus and species.	Cameron.				Total.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Cast nets:								
Bream and sunfish					3,000	$180	3,000	$180
Mullet	4,000	$120	4,000	$120	54,400	1,882	56,500	1,955
Trout	1,500	60	1,500	60	10,600	490	11,300	530
Miscellaneous fish	2,000	60	2,000	60	17,300	748	17,700	765
Total	7,500	240	7,500	240	85,300	3,300	88,500	3,430
Lines:								
Bluefish					8,000	640	8,000	640
Catfish	23,500	1,175	25,000	1,250	91,500	3,760	39,500	1,815
Channel bass					28,500	1,120	31,150	1,185
Drum, salt-water					4,000	80	4,000	80
Jewfish					32,500	1,300	36,500	1,500
Sheepshead					16,400	685	19,750	824
Snappers, red					22,000	1,250	4,800	240
Trout					20,200	932	21,600	995
Miscellaneous fish	12,000	500	13,500	550	34,500	1,233	37,100	1,316
Total	35,500	1,675	38,500	1,800	257,600	11,000	202,400	8,595
Spears:								
Flounders					64,000	3,030	67,000	3,200
Miscellaneous:								
Oysters	29,400	1,700	29,400	1,700	2,378,250	105,975	2,926,000	121,910
Crabs	3,000	50	3,300	55	189,400	5,030	190,800	5,095
Shrimp	38,000	1,180	36,800	1,130	241,500	7,555	175,800	5,670
Terrapins					34,530	6,000	5,900	1,457
Turtles	50,000	440	48,000	410	489,400	7,757	500,000	7,955
Total	120,400	3,370	117,500	3,295	3,333,080	132,317	3,798,500	142,087
Grand total	206,450	6,864	205,500	6,865	6,606,250	270,983	6,975,300	279,605

The shore fishing industries.—The extent of the wholesale fish and oyster trades and of the turtle-canning industry of Texas is shown in Table 77. Thirteen firms, located at Galveston, Matagorda, Corpus Christi, Lavaca, Aransas, and Point Isabel, were engaged in 1890; these employed 161 persons, had shore property and cash capital worth $161,000, and paid $32,200 in wages. The products handled cost $260,705 and when sold brought $426,050, the enhancement in value being $165,345, a sum representing the gross profits of the trades.

77.—Table showing the wholesale oyster and fish trades and turtle canning of Texas in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	11	13
Number of employés	135	161
Value of property	$78,500	$107,500
Cash capital	$39,500	$53,500
Wages paid	$28,700	$32,200
Oysters handled ... barrels	118,650	130,900
Value paid	$106,840	$118,600
Value received	$177,975	$196,350
Fish handled ... pounds	3,030,000	3,320,000
Value paid	$126,980	$137,650
Value received	$195,850	$216,800
Turtles handled ... pounds	210,000	243,000
Value paid	$3,900	$4,455
Cans prepared: 2-pound meats ... number	35,000	40,000
2-pound soups ... number	3,000	3,600
3-pound soups ... number	5,400	6,000
Value received	$10,900	$12,900
Enhancement in value of products	$147,005	$165,345

4.—REPORT ON A COLLECTION OF FISHES FROM THE ALBEMARLE REGION OF NORTH CAROLINA.

BY HUGH M. SMITH, M. D.

INTRODUCTORY NOTE.

In the summer of 1888 the U. S. Fish Commission conducted an extensive investigation of the fresh-water streams of the Alleghany region of North Carolina, Virginia, and Tennessee, with reference to the fish occurring in the different river basins of that section. Professor Jordan, under whose direction the field work was accomplished, has published a report on the results of the explorations*.

The inquiry in North Carolina was very complete and comprehensive for the region specified; but by referring to the report cited it will be seen that a large portion of the State, extending from the coast to the Piedmont region, so called, and embracing many thousand square miles, was not included in that investigation, nor is it apparent that others have examined the fresh waters of this area with reference to the fishes inhabiting them. In this territory, therefore, it was conceived that any ichthyological work would be of interest in itself and also valuable as a supplement to the investigations of the upper courses of the important rivers debouching into the lowlands. Accordingly, in April, 1892, the writer was instructed to make an examination into the fish life of this region, acting under instructions from Mr. Richard Rathbun, who is in charge of the scientific work of the Commission.

Only a brief time could, at this period, be devoted to this work, and it was decided to restrict the inquiry to Albemarle Sound and its tributaries, with a view to make the collections in that hydrographic basin as complete as possible, rather than cover a wider area less thoroughly. The possibility of making collections at this season was something of an experiment; it was not known that the condition of the water would permit the capture of those smaller forms about which we have the least information; but it was thought that certain features of the fauna could be better observed than at other times, and that some light might be thrown on the presence and movements of the local fishes immediately after their emergence from their winter habitat. An opportunity was also afforded to inspect some of the noted shad and alewife fishing stations of this region.

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*Report of Explorations made during 1888 in the Alleghany Region of Virginia, North Carolina, and Tennessee, and in western Indiana, with an account of the fishes found in each of the river basins of those regions. By David Starr Jordan.—Bulletin U. S. Fish Commission, 1888.

Albemarle Sound is said to be the largest coastal body of fresh water in the world, and it is certainly the largest of the kind in the United States. It is 60 miles long from east to west, and has a maximum width of 15 miles and an average width of 6 or 8 miles; its area is 450 square miles. At its eastern extremity it communicates on the north with Currituck Sound, and on the south it merges into Roanoke and Croatan sounds, through which it enters the ocean by means of openings in the sandy "banks" which skirt the ocean front of the State.

The shores of the sound are low throughout and for the most part marshy; they are very generally fringed by cypress, juniper, and other trees which are characteristic features of the paludal sections of this State. Some of the longest rivers of the State empty into the sound and numerous short streams enter it. On its northern shore, four short rivers, rising in swampy areas in or adjacent to the Dismal Swamp, enter the sound by wide mouths; these are the North, Pasquotank, Little, and Perquimans rivers. At the extreme western end of the sound, the Chowan River terminates on the northern side in a broad estuary, and the Roanoke River, flowing from the west, enters by two narrow mouths. On the southern side, there are two short, sluggish streams known as the Alligator and Scuppernong rivers.

Viewed from the standpoint of commercial fishing, the Albemarle Sound region is one of the most important in the United States, and there is no other fresh-water basin on the Atlantic coast having such extensive fisheries. The especially prominent fish occurring here are the shad, alewives, striped bass, black bass, and white perch. The seine fisheries for shad and alewives are by far the largest in the country. In 1890 the following quantities of the more important economic fishes were taken in the sound and its tributaries, the total output reaching the enormous quantity of 18,003,102 pounds, with a value to the fishermen of $439,581:

Species.	Pounds.	Value.
Alewives	13,723,573	$140,647
Black bass	380,090	19,206
Catfish	21,085	651
Eels	145,700	9,414
Pike	32,010	1,545
Shad	3,138,100	217,206
Strawberry bass	28,075	1,106
Striped bass	474,744	25,390
Sturgeon	118,085	3,467
White perch	414,745	15,492
All other species	180,235	5,327

Collections were made at numerous places in the basins of the Pasquotank and Roanoke rivers, and in Edenton Bay, at the mouth of the Chowan River. In the following pages the localities in which collecting was done are described and the species found in each of the different sections are enumerated. The physical conditions prevailing at the time of the investigation were somewhat unfavorable. The water temperature, elsewhere recorded, was very low and no doubt kept the smaller fishes in the deepest parts of the streams, where they were least accessible. High, muddy water was generally met with, which, together with large quantities of drift wood, greatly interfered with seining and reduced to some extent the number of specimens and species obtained. To these circumstances is to be especially attributed the relative scarcity, as regards both species and individuals, of cyprinoids and other small fish, as shown in the following lists. Nevertheless it is thought that the collection is sufficiently complete to convey a satisfactory idea of the fish life of the region.

The number of specimens preserved was about 800; these, together with others observed but not collected, represent 18 families, 35 genera, and 45 species, as follows:

1. Acipenser sturio oxyrhynchus.
2. Amia calva.
3. Ameiurus albidus.
4. Ameiurus nebulosus.
5. Ælurichthys marinus.
6. Erimyzon sucetta.
7. Moxostoma anisurum.
8. Moxostoma crassilabre.
9. Hybognathus nuchalis.
10. Notropis hudsonius.
11. Notropis niveus.
12. Semotilus atromaculatus.
13. Notemigonus chrysoleucus.
14. Cyprinus carpio.
15. Clupea mediocris.
16. Clupea pseudoharengus.
17. Clupea æstivalis.
18. Clupea sapidissima.
19. Brevoortia tyrannus.
20. Dorosoma cepedianum.
21. Fundulus diaphanus.
22. Gambusia patruelis.
23. Lucius americanus.
24. Lucius reticulatus.
25. Anguilla chrysypa.
26. Tylosurus marinus.
27. Querimana gyrans.
28. Menidia beryllina.
29. Aphredoderus sayanus.
30. Centrarchus macropterus.
31. Pomoxis sparoides.
32. Chænobryttus gulosus.
33. Enneacanthus obesus.
34. Enneacanthus simulans.
35. Lepomis auritus.
36. Lepomis pallidus.
37. Lepomis gibbosus.
38. Micropterus salmoides.
39. Etheostoma nigrum olmstedi.
40. Perca flavescens.
41. Stizostedion vitreum.
42. Roccus lineatus.
43. Morone americana.
44. Paralichthys lethostigma.
45. Achirus fasciatus.

Prof. Jordan, in the report cited, speaking of the fishes of the lowlands, makes the following remarks which have application to this collection and may appropriately be quoted:

> Additional confirmation has been given to the idea that the lowland swamp fishes of the United States are remains of an earlier and, in part, now extinct fauna. To such a fauna, it is generally admitted, belong the genera *Amia* and *Lepisosteus*. To this list I would add *Umbra, Lucius, Chologaster, Aphredoderus, Jordanella, Elassoma, Acantharchus, Pomoxis, Enneacanthus, Mesogonistius,* and, doubtless, *Percopsis*. The upland fishes seem to be mostly of recent origin, the species of *Notropis* and *Etheostoma* probably latest of all.

A study of the common names applied to the fishes of this section is not without interest. Some very inappropriate and singular names are in use which do not appear to have been recorded. An amateur ichthyologist making up a list of the fishes of this region based on the local names would be led to some very strange conclusions and would not add to his reputation by mentioning the "California salmon" and "brook trout" as being not uncommon, while he would probably experience considerable difficulty in identifying such fish as the "salt-water pike," "flier," and "horse-fish."

From another point of view the presentation of the popular names is important. With the advent of fishermen from other States or localities, new names will be brought in, and the original designations employed in the region will in time be supplemented or supplanted. It therefore becomes a matter of interest to record the names in present use.

In the annotated lists under each locality, the vernacular synonyms heard during this inquiry have been given. In the following table some of these local names have been brought together for convenience of reference and for comparison, their distribution among the principal fishing towns of the sections visited being shown. The list could doubtless be augmented by additional inquiries, and a few common designations known to be employed in this region, but which were not heard by the writer, have been omitted. The absence of a check mark (×) in the table indicates either that the species was not detected or that no common name was heard for it.

Common names applied to certain fishes in the Albemarle region of North Carolina.

Scientific names.	Local names.	Elizabeth City.	Edenton.	Plymouth.	Weldon.
Amia calva	Blackfish		×	×	
	Grindle	×	×		
Ameiurus albidus	Black cat	×	×		
	Bullhead			×	
	Catfish				×
	Creek cat			×	
	River cat			×	
	Sound cat			×	
	White cat	×	×		
Ameiurus nebulosus	Yellow cat	×	×	×	
Ælurichthys marinus	Silver cat		×		
Moxostoma crassilabre	Golden-finned mullet		×		
	Golden mullet	×	×		
	Horsefish				×
	Mullet				×
	Redfin				×
	Redhorse	×	×	×	
	Redhorse mullet		×		
	Sucking mullet		×	×	
	Trout sucker		×		
Moxostoma anisurum	Sucking mullet			×	
Notemigonus chrysoleucus	Roach	×	×	×	×
	Shiner	×			
	Shiner sunfish	×			
Clupea mediocris	Hickory shad		×	×	
	Jack	×	×		
Clupea pseudoharengus	Goggle-eye	×	×	×	
Clupea æstivalis	Blueback		×		
	Herring	×	×	×	
	May herring		×		
	School herring		×	×	
Brevoortia tyrannus	Bugfish		×		
	Fatback	×	×		
Dorosoma cepedianum	Gizzard shad	×	×	×	
	Mud shad	×			
	Nanny shad	×	×		
	Shiner		×		
Lucius americanus	Pike		×	×	
	Red-finned pike				×
Lucius reticulatus	Black pike			×	
	Duck-billed pike		×		
	Jack			×	
	Pike	×	×	×	
	Red-finned pike			×	
Tylosurus marinus	Doctor-fish		×		
	Green gar	×	×		
Centrarchus macropterus	Flier		×	×	
	Mill-pond perch			×	
	Sunfish			×	
Pomoxis sparoides	Speckled perch	×	×	×	
Chænobryttus gulosus	Chub			×	
	Goggle-eye		×	×	
	Mud chub			×	
Lepomis auritus	Leather-ear		×		
	Red-belly		×		
	Yellow-belly		×		
Lepomis pallidus	Blue joe		×		
	Blue perch				×
Lepomis gibbosus	Red-belly		×	×	
	Robin			×	
	Robin perch	×			
	Yellow-belly		×	×	
Micropterus salmoides	Chub	×	×	×	×
	Welchman	×			
Perca flavescens	Englishman		×		
	Raccoon perch		×	×	
	Redfin	×			
Stizostedion vitreum	Brook trout			×	
	California salmon	×			
	Golden trout	×			
	Pickerel		×		
	Salmon				×
	Salt-water pike	×			
	Wall-eyed pike	×			
Roccus lineatus	Rock	×	×	×	×
Morone americana	Perch	×	×	×	
	Silver perch				×

THE PASQUOTANK RIVER.

This is the largest of the short rivers flowing southeast into the northern side of Albemarle Sound. It has its origin in the Dismal Swamp, and in the upper part of its course is shallow, narrow, and tortuous. Below Elizabeth City, however, it suddenly becomes a wide and deep stream of considerable commercial importance, and at its mouth, 18 miles below the city named, has a width of 8 miles. The water is strongly contaminated with juniper and cypress, which give it a characteristic dark color and peculiar taste. The other short rivers on the northern side of the sound are essentially similar in all physical respects, and it may safely be assumed that their fish faunas are also alike. Collections were made at the following places in the basin of this river:

(*a*) *Pasquotank River at Elizabeth City.*—The river at this point is about half a mile wide, with low banks, wooded or bush-fringed shores, and occasional bayous or marshy tracts. Temperature of water April 8, 76° F.

(*b*) *Davis Bay.*—This is a detour in the right bank of the Pasquotank, about 5 miles below Elizabeth City. The shores are for the most part sandy. Seining was done off the mouth of a small creek, on a sand bar formed by the mutual action of creek and river. Temperature of water April 8, 78° F.

(*c*) *Newbegun Creek.*—This is a short and shallow but broad tributary of the Pasquotank, entering the right side of that river about 8 miles below Elizabeth City. The bottom is mostly of mud. The shores, which are low and marshy, are wooded with cypress, pine, and smaller shrubbery. The water is fresh, and normally of a brownish color, but at the time of visit was somewhat muddy, owing to a recent rain. The creek is fed by small, sluggish streams, which emerge from the cypress swamps, and has little or no current. Temperature of water April 8, 78° F. There is some commercial fishing in this creek, of which advantage was taken in determining the character of the fish fauna; haul seines, gill nets, and eel pots are the apparatus used.

(*d*) *Road Ditches and Drains.*—Throughout this county the principal roadways are bordered on either side by ditches, which communicate with sloughs and drains running through the adjoining farm lands and ultimately finding their way into the Pasquotank on the east or the Perquimans on the west. The ditches are usually only 1 or 2 feet wide and a few inches deep; but in places they are somewhat wider and deeper. The smaller ditches must dry up at times, but the larger ones probably retain their water continually. In many places there is a growth of filamentous algæ. A species of fresh-water shrimp (*Palæmonetes exilipes*) is abundant in them. Collections were made at a dozen different points. A recent rain had made the water somewhat muddy. Temperature April 8, 77° F.

In the following list of fishes the localities in which the various species were observed are indicated by the use of the letters (*a*, *b*, *c*, and *d*) which precede the names of the stations in the foregoing paragraphs.

FISHES OF THE PASQUOTANK RIVER.

1. **Acipenser sturio oxyrhynchus** (Mitchill). *Sturgeon.* (*a.*) Not abundant in the Pasquotank and much less numerous than formerly.
2. **Amia calva** Linnæus. *Grindle.* (*a, c.*) Common. Examples 2 feet long observed. Of no commercial value, the flesh being "cottony," but is sometimes eaten by negroes.
3. **Ameiurus albidus** (Le Sueur). *Black cat; White cat.* (*a, b, c.*) Very abundant. Most of the fish taken at this time by the commercial fisherman were small, but some were a foot in length and a few were 20 inches long. Some of the largest specimens had full-grown alewives in their gullets when caught. Under the name "white cat," the fishermen recognize the fish having a milky or dusky color, dull red fins with dark edges, and a white iris. They are most common in the lower river, where they seem partial to the shoals, whence, probably, their bleached appearance. Between the black and white forms there is every gradation of color.

   The main run of alewives in the Pasquotank River is always followed by a noticeable increase in the abundance of catfish. The fishermen have a saying that when the catfish arrive the herring season is over. The catfish are thought to follow the alewives for the purpose of feeding on their spawn. In April, 1887, during a period of four days, Mr. George Waters, of Elizabeth City, caught 118,000 herring; the run suddenly ceased, and on the fifth day no herring were taken, but an enormous haul of catfish was made.
4. **Ameiurus nebulosus** (Le Sueur). *Yellow cat.* (*a, c.*) Much less numerous than the preceding. Most common about wharves, feeding on refuse. Above dark green, sides golden yellow obscurely mottled with green, beneath pale yellowish or white. An example from station *a* has the following features: Length, 12¾ inches; head in body, 3½; depth, 4; anal base, 4; pectoral spine in head, 2½; anal rays, 22.
5. **Cyprinus carpio** Linnæus. *Carp.* (*a.*) First appeared in this river as the result of the breaking of the dam of a carp pond, and is now occasionally taken. The peculiar hard water of the river appears to improve the food value of the fish; three people interviewed spoke in high terms of its edible qualities. Fish 20 inches long have been caught.
6. **Hybognathus nuchalis** Agassiz. (*b, c.*) Apparently the most abundant cyprinoid in this river; 41 specimens preserved, from 2½ to 4½ inches long. Dorsal, 7 or 8; anal, 8; head, 4 or 4¼; depth, 4¼ or 4½; eye, 3 to 3½; scales, 5–37–4 to 5–45–4; scales before dorsal, 14 or 15.
7. **Notropis hudsonius** (Clinton). (*b.*) Three specimens. In these the variations in the dental formulæ are so marked that it may be proper to describe the fish. Color above pale green, the scales with dark edges. A lateral silvery band, with black punctulations terminating in a distinct roundish black spot at base of caudal. Lateral line complete, nearly straight except at origin. Dorsal rather nearer snout than base of caudal and over ventrals; the latter reaching the vent; caudal deeply forked. Mouth on level with lower edge of orbit, small, somewhat oblique, not reaching half way to eye; lower jaw included. Snout rugose, rounded. Eye large, longer than snout, and equal to interorbital. Teeth hooked, with well-developed grinding surface. Other features of these specimens are brought out in the following table:

Specimens.	Length.	Head.	Depth.	Eye.	Dorsal.	Anal.	Scales.	Scales before dorsal.	Teeth.
	Inches.								
No. 1	2¼	4	5	2⅔	8	8	5–35–3	15	2, 4–4, 2
No. 2	2¼	4¼	5¼	2¼	8	8	5–36–3	15	0, 4–4, 0
No. 3	2⅜	4¼	4¾	2⅔	8	8	5–35–3	16	0, 4–4, 0

In his definition of the genus *Hudsonius*, in which the species under consideration was placed, Girard* gives the variations in the teeth as 2,4–4,2, 2,4–4,1, 0,4–4,2, and 0,4–4,1. In recent works, the formula 2,4–4,2 is not mentioned, and the absence of teeth from the inner row, as in two of these specimens, does not appear to have been previously noticed.

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*Proc. Acad. Nat. Sci. Phila., VIII, 1856, p. 210.

8. **Notemigonus chrysoleucus** (Mitchill). *Shiner; Shiner sunfish; Roach.* (*a, b, c, d.*) Everywhere abundant. Said to be the principal food of the black bass. The largest specimen obtained was 7¾ inches long and was a female in condition to spawn; the ventral fins were uniformly crimson in color, the anal dull orange at base, with a black margin. In other examples the fins are yellowish. Dorsal, 7 or 8; anal, 14 or 15; scales, 10–45–3 to 10–50–3.

9. **Clupea pseudoharengus** Wilson. *Goggle-eye.* (*a, b, c.*) Less numerous at this time than the following species and occurring in smaller schools. Two specimens 2½ and 4⅛ inches long, respectively, were seined in Newbegun Creek.

10. **Clupea æstivalis** Mitchill. *Herring.* (*a, b, c.*) Adults and young very abundant. Numerous specimens about 1½ inches long were taken in Davis Bay and Newbegun Creek, April 8. These in life were transparent, with the back, dorsal and caudal fins, anal base, and muzzle covered with fine black spots; head, 3⅛; depth, 4¼; eye, 3; dorsal, 16; anal, 19. As the adult fish had just begun to enter the Pasquotank to spawn, the presence of such young individuals, having the appearance of fish about 3 months old, was very unexpected. The explanation of their occurrence seems to be that in all probability a school of spawning fish entered Albemarle Sound late in the fall of 1891 and the young fish remained in the region through the winter.

11. **Clupea sapidissima** Wilson. *Shad.* (*c.*) In 1892, after the shad had entered Albemarle Sound, a protracted period of unfavorable weather, consisting of cold northerly and easterly winds, kept them out of the rivers on the northern side of the sound, and up to April 7 the run had not begun in the Pasquotank, although the fish were daily expected, the waters of the sound being reported as teeming with them. In Newbegun Creek one adult male, a "forerunner" of the fishermen, was taken April 8. Shad have been known to spawn in the strong juniper and cypress water of the upper course of the river.

12. **Brevoortia tyrannus** (Latrobe). *Fatback.* (*a.*) Small bodies of adult menhaden occasionally ascend the Pasquotank River to Elizabeth City, and schools of young fish are also observed; this is usually during a period of dry weather, when the water of Albemarle Sound becomes brackish. This habit of the fish of ascending fresh-water streams has also been observed in the Potomac River. In 1892, at the shad-hatching station of the U. S. Fish Commission, about 15 miles below Washington, numerous young specimens about 4 inches long were taken early in June and 2 adults were secured in the seine in May. The water here is rarely brackish and at these times was quite fresh.

13. **Dorosoma cepedianum** (Le Sueur). *Nanny shad; Mud shad.* (*a, b, c.*) Specimens from 3 to 6 inches long extremely common; adults also numerous. Young examples from the Pasquotank River near Elizabeth City have the dorsal and caudal uniformly dusky and the pectorals, ventrals, and anal with dark edges; specimens from Davis Bay and Newbegun Creek have the lower fins white. The dark spot on the shoulder of immature individuals is lustrous purple in life.

14. **Fundulus diaphanus** (Le Sueur). (*a, b, c.*) Numerous small specimens obtained, the largest 2⅝ inches long. Very abundant in Newbegun Creek. Two males 2⅝ inches in length from Davis Bay are marked by about 21 dark transverse stripes, alternating with silvery ones; the dorsal is distinctly mottled with dark and white spots; the lower fins in one specimen are bright yellow, in the other white; head, 3½; depth, 4⅛; eye in head, 3⅛; dorsal, 14; anal, 11 and 13; scales, 45–18 and 45–20; scales before dorsal, 21 and 22.

15. **Gambusia patruelis** (Baird & Girard). (*b, c, d.*) Exceedingly common. The fish occurring in ditches and drains are very pale and show no trace of a dark bar or spot below the orbit. Specimens from the colored waters of the river and Newbegun Creek are dark greenish-brown and have a distinct purple bar beneath the eye. The proportion of males to females is as 1 to 3. Ova at this time not in an advanced state of development.

16. **Lucius reticulatus** (Le Sueur). *Pike.* (*a, c.*) Common. Often taken by the commercial fishermen, especially in creeks and bayous. Examples from 8 to 18 inches long observed, feeding largely on alewives at this time.

17. **Anguilla chrysypa** Rafinesque. *Eel.* (*a, b, c.*) Taken at almost every haul of the seine. Specimens from 2 inches to 2 feet in length observed.

18. **Tylosurus marinus** (Bloch & Schneider). *Green gar.* (*c.*) Not rare in the lower river. A specimen obtained at Newbegun Creek was 18 inches long, which is the usual size observed. The negro fishermen are fond of this fish and consider its flesh good.

19. **Querimana gyrans** Jordan & Gilbert. (*b, c.*) This diminutive mullet was very abundant in small schools in Davis Bay, where hundreds were taken in company with the other smaller fishes credited to that place. In Newbegun Creek the species was rare, only one specimen being obtained in numerous hauls of the seine.

This species was originally described from Key West, Fla., and has not previously been observed north of Charleston, S. C. It is a marine fish, whose occurrence in the Albemarle region so far from salt water is a matter of considerable interest.* The specimens at hand agree very closely with the original description by Jordan & Gilbert.† The points of similarity and difference are brought out in the following comparative table:

Locality.	Head.	Depth.	Eye in head.	Eye in snout.	Eye in inter-orbital.	Dorsal.	Anal.	Scales.
Key West, Fla	3¼	3¾	3⅓	¾	1	IV-I, 7	II, 7	28 or 29
Davis Bay, N. C........	3⅓	3½	3	⅞	1	IV-I, 8	II, 9	28 to 30

Examples from this region are uniformly larger than the types, being from 1¼ to 1½ inches long, instead of ¾ of an inch; Dr. Jordan and others, however, have since taken specimens as large as ours. The opercles and cheeks are covered with large scales, which are deciduous and often absent in alcoholic specimens.

20. **Menidia beryllina** (Cope). (*b, c.*) Eight specimens about 2 inches long. Head, 4⅓; depth, 5⅓; eye, 3; dorsal, IV-I,10, V-I,10, or V-I,11; anal, I,16 or I,17; scales, 40–8.

21. **Pomoxis sparoides** (Lacépède). *Speckled perch.* (*a, c.*) Common.

22. **Lepomis gibbosus** (Linnæus). *Robin perch.* (*a, c.*) Very abundant.

23. **Micropterus salmoides** (Lacépède). *Chub; Welchman.* (*a.*) Abundant. Often seen jumping out of the water.

24. **Etheostoma nigrum olmstedi** (Storer). (*c.*) Two specimens.

25. **Perca flavescens** (Mitchill). *Redfin.* (*a, c.*) Spawns in February. Less abundant and valuable than the white perch. The paired and anal fins are bright red, whence the local name.

26. **Stizostedion vitreum** (Mitchill). *Wall-eyed pike; Salt-water pike; California salmon.* (*a, c.*) In the Pasquotank River numbers of these fish are taken by the net fishermen; they are 12 to 15 inches long and are said to have been known in the river only a few years. Under the mistaken impression that they are salt-water fish which have wandered here, some of the fishermen call them "salt-water pike," to distinguish them from the fresh-water pike (*Lucius*). The equally inappropriate name of "California Salmon" was also heard in the lower part of the river. The fish are hardly abundant enough to have commercial importance. They have become popular locally, however, and always meet with ready sale.

27. **Roccus lineatus** (Bloch). *Rock.* (*a.*) A common spring migrant in the Pasquotank. Specimens from 6 to 30 inches long observed.

28. **Morone americana** (Gmelin). *Perch.* (*a, b.*) More numerous and more valuable as a food-fish than the yellow perch. Young fish 2 or 3 inches in length very abundant, seined with *Hybognathus nuchalis, Menidia beryllina, Querimana gyrans*, etc.

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*The range of this species has recently been still further extended by its capture in the Chesapeake Bay. Mr. W. C. Kendall, of the U. S. Fish Commission steamer *Fish Hawk*, states that the fish was abundant in the lower Chesapeake and a number of specimens were taken July 8, 1892. Mr. Kendall observed the fish gyrating, as described by Jordan & Gilbert, a habit not observed by the writer in North Carolina.

†Proc. U. S. Nat. Mus., 7, 1884, p. 26.

EDENTON BAY.

Edenton Bay is a broad indentation lying east of the mouth of the Chowan River, from which it is separated by a large, swampy projection of land. It is about 2½ miles long and 3 miles wide at its mouth. The town of Edenton is at its head; here two small creeks, arising in wooded swamps, flow into the bay on either side of that place. The bay is an important fishing-ground for shad, alewives, striped bass, etc., and is resorted to by the fishermen of Edenton. The waters of this bay were examined at the following points:

(*a*) *Edenton.*—Collections were made at the mouth of a small creek entering the bay from the east. On the right bank of the creek there are wharves and fish-houses; the refuse here thrown into the water attracts schools of small fish, such as minnows and silversides; also yellow and white perch, sunfish, etc. The shore of the creek opposite the town is low, partly wooded, and for the most part sandy; the bottom in places near the shore exhibited a sparse growth of *Myriophyllum* in small clusters, in which darters were found in considerable numbers. A fresh-water shrimp (*Palæmonetes exilipes*) was present in abundance, and numerous specimens of a crayfish (*Cambarus blandingii*) were taken. Temperature of water April 11, 56° F.

(*b*) *Reedy Point.*—This locality is at the western side of the mouth of the bay and is resorted to by the pound-net fishermen, from whom specimens were obtained. At the time of visit, shad, alewives, striped bass, catfish, flounders, perch, suckers, etc., were being taken.

(*c*) *Skinner Point.*—This is at the eastern side of the mouth of Edenton Bay and is the former site of an important steam-seine fishery. The shore here is high and sandy and is admirably adapted to seine fishing. A heavy wind rendered the water muddy and made collecting difficult, but a large number of specimens were nevertheless secured. Temperature of water April 9, 64° F.

(*d*) *Cypress Swamp, near Edenton.*—A small swamp southeast of Edenton drains into Edenton Bay by a shallow creek which crosses the road to Skinner Point about 3 miles from Edenton. The water is colored a peculiar reddish-brown by the cypress and juniper trees in the swamp. The creek at this point appeared to contain *Gambusia patruelis* to the exclusion of almost every other species. Temperature of water April 9, 67° F.

All the roadside ditches and drains teem with *Gambusia*, which may be said to be the characteristic fresh-water fish of this section.

In the following list of fishes observed in Edenton Bay, the species occurring at the four stations mentioned are indicated by the letters (*a*, *b*, *c*, *d*) which precede the description of the places.

FISHES OF EDENTON BAY.

1. **Acipenser sturio oxyrhynchus** (Mitchill). *Sturgeon.* (*b.*) Caught in considerable numbers, but is much less numerous than formerly and the demand is greater than ever before, owing to the market which has been created for the roe.
2. **Amia calva** Linnæus. *Grindle; Blackfish.* (*b.*) Common in the sound, where it reaches a length of 2 feet or more. The young fish are said to follow the female, as newly hatched chickens do a hen.
3. **Ameiurus albidus** (Le Sueur). *Black cat; White cat.* (*a, b.*) Common.

4. **Ameiurus nebulosus** (Le Sueur). *Yellow cat.* (*a, b.*) Common. Not esteemed as a food-fish and of little commercial value.

5. **Ælurichthys marinus** (Mitchill). *Silver cat.* This fish is casually seen in Edenton Bay, and is recognized by the fishermen as a straggler from salt-water. It is called "silver catfish," as I am informed by Mr. J. L. Leary, of the U. S. Fish Commission, who has taken it while shad-fishing.

6. **Erimyzon sucetta** (Lacépède). (*a.*) A single specimen, 4¼ inches long, was obtained at Edenton. It has an obscure dark bar along the side and about six broad irregular cross-bars of a dark bluish color in life. Body above dusky, with a bronze reflection, below cream color. Dorsal and caudal rays dark; ventral and pectoral fins pale, with dark tips. Head, 4; depth, 3½; eye, 4½; dorsal, 12; anal, 6; ventral, 9; scales, 45–16.

7. **Moxostoma crassilabre** (Cope). *Redhorse; Redhorse mullet; Sucking mullet; Trout sucker; Golden mullet; Golden-finned mullet.* (*b.*) [*Ptychostomus crassilabris* Cope; *Moxostoma crassilabre,* Jordan & Gilbert, Synopsis; not *Moxostoma crassilabre,* Jordan, Manual, 5th ed., which is *Moxostoma breviceps* (Cope).] Fish which are provisionally identified as this species are common in the sound at this time and are taken with the shad and alewives, with which species they appear to be ascending the rivers. All the common names given were heard at Edenton and vicinity. "Golden mullet" and "golden-finned mullet" are trade names, which are also in use at Elizabeth City and other places on the sound. The smaller individuals with plainer colors are usually known as "sucking mullet" and "trout suckers," the other names being applied to the large marketable fish.

An example 15 inches long from the pound nets at Reedy Point seems to be identical with a single large fish taken by Jordan in the Little River, a branch of the Neuse, at Goldsboro, N. C. Back elevated, compressed, the greatest depth 3½ in length. Head very small, 5 in length, broad above. Snout blunt, overhanging mouth. Mouth moderate, the lips plicate, the lower lip truncate behind and finely papillose. Eye 4¼ in head, 2⅛ in interorbital, 1½ in snout. Dorsal with the free border rather deeply incised, the longest ray longer than head and base of fine; dorsal rays, II, 13. Caudal lobes about equal. Scales, 6–45–5. General color pale yellowish-red, dusky above, lighter beneath, with silvery reflections. Lower fins pale orange or red, the dorsal with a black membrane. Each scale above lateral line with a dark spot at base of exposed part, this marking being most pronounced on the back. Cope's description of *M. crassilabre* agrees very closely with the foregoing, the only noticeable variation being in the color of the lower fins, which Cope says are white.

8. **Hybognathus nuchalis** Agassiz. *Choby.* (*a.*) Six specimens, largest 2¾ inches long. Head, 4 to 4¼; depth, 4 to 4½; eye, 3 to 3¼; scales, 5–39–4 to 5–41–4; scales before dorsal, 13; dorsal, 8; anal, 7.

9. **Notropis hudsonius** (Clinton). *Choby.* (*c.*) Only one specimen, similar to those from the Pasquotank River and with the teeth 2,4–4,2. Length, 2⅛ inches; head, 4; depth, 4½; eye, 2½ in head, ½ in snout, ⅜ in interorbital; scales, 6–34–3; scales before dorsal, 14; dorsal, 8; anal, 8. Dorsal over ventrals. A black spot at base of caudal. Teeth slightly hooked, with grinding surface.

10. **Notropis niveus** (Cope). (*a.*) Abundant; 27 specimens, the largest 1¾ inches in length. Body above cross-hatched with pale brownish; a dark lateral band. Head, 4; depth, 4½ to 4¾; eye, 3 to 3½; dorsal, 8; anal, 8 or 9; scales, 6–35–3 to 6–38–3; scales before dorsal, 15 or 16; teeth, 1,4–4,1 or 1,4–4,0, slightly hooked, with grinding surface.

Dr. Charles H. Gilbert has kindly examined an example of this series, and, while he would not express a final opinion in the absence of other specimens, thinks it referable to this species. Dr. Jordan records this fish from the upper waters of the Chowan, Roanoke, Pamlico, and other rivers of North Carolina, where it was found to present so many variations that he is "not sure whether it is really distinct from *N. whipplei.*" There are in the collection of Prof. B. W. Evermann, from the Tar River at Rocky Mount, N. C., some specimens of this species similar in all respects to those from Edenton.

11. **Notemigonus chrysoleucus** (Mitchill). *Roach.* (*b.*) Abundant at this time. Caught in seines and pound nets, but of no commercial value.

12. **Clupea mediocris** Mitchill. *Hickory shad; Jack.* (*b.*) Common.

13. **Clupea pseudoharengus** Wilson. *Goggle-eye.* (*b.*) Abundant. The fishermen say the goggle-eye is the "forerunner of the herring."

14. **Clupea æstivalis** Mitchill. *School herring; Blueback; May herring.* (*b.*) Abundant.

15. **Clupea sapidissima** Wilson. *Shad.* (*b.*) Now taken in large numbers in the dutch nets. This has long been one of the most important fishing-grounds for shad in the Albemarle region. At Skinner Point, near the mouth of Edenton Bay, at the seine fishery of Mr. H. G. Skinner, 100,000 shad were caught in 1874 in a single seine during a fishing season of 52 days; this is the largest catch ever made on the sound in one seine.

16. **Brevoortia tyrannus** (Latrobe). *Bugfish; Fatback.* Occurs during dry weather, when there is a westward extension of the brackish water. Young fish in schools are also observed at such times.

17. **Dorosoma cepedianum** (Le Sueur). (*a, b, c.*) *Gizzard shad; Nanny shad; Shiner.* Common.

18. **Fundulus diaphanus** (Le Sueur). (*a.*) Apparently rare, at least at this season. Only one specimen obtained. This is a female, 1½ inches long; the sides are marked by 12 narrow dark cross-bars, and the back has a few dark mottlings; the scales are all edged with fine dark spots. Head, 3⅓; depth, 5; eye, 3½ in head, 1 in snout, 1 in interorbital; dorsal, 12; anal, 11, the first rays sheathed by the oviduct; scales, 45–15.

19. **Gambusia patruelis** (Baird & Girard). (*a, d.*) Abundant. Examples from Edenton are uniformly pale; those from a cypress swamp near that place partake of the dark color of the water.

20 **Lucius americanus** (Gmelin). *Pike.* (*d.*) One small example from cypress swamp, the only other specimens obtained therein being *Gambusia*. Length, 3 inches; head, 2⅞; depth, 5½; eye, 5⅓ in head, 2 in snout; branchiostegals, 13; dorsal, 13; anal, 11; lateral line, about 105.

21. **Lucius reticulatus** (Le Sueur). *Pike; Duck-billed pike.* (*b.*) Common.

22. **Anguilla chrysypa** (Rafinesque). *Eel.* (*a, c.*) Small examples common.

23. **Tylosurus marinus** (Bloch & Schneider). *Green gar; Doctor-fish.* (*b.*) Not rare in the sound, where it is caught in pound nets. Mr. J. L. Leary, of the U. S. Fish Commission, who formerly fished in this region for a number of years, says the name "doctor-fish" is sometimes given to this species by the fishermen of Edenton.

24. **Querimana gyrans** Jordan and Gilbert. (*a, c.*) Apparently more abundant than in the Pasquotank. The collection contains 140 specimens from Edenton and 39 specimens from Skinner Point. The fish seem to go in small compact schools; all the examples from station *c* were taken at one haul of the seine, while 8 or 10 other trials in the same spot yielded none.

25. **Menidia beryllina** (Cope). (*a, c.*) Five specimens from Edenton agree in the main with the usual descriptions of this species. The depth is a little less, however, the eye larger, and two of the specimens have the dorsal formula VI–I,10. The principal features are shown in the table:

Number.	Length.	Head.	Depth.	Eye.	Dorsal.	Anal.	Scales.
	Inches.						
1	1⅞	4⅕	6	2⅔	VI–I, 10	I, 17	42–9
2	1⅞	4⅓	6⅓	2½	V–I, 11	I, 17	40–8
3	1⅞	4⅕	6¼	2⅔	VI–I, 10	I, 18	40–8
4	1⅞	4⅓	6½	2⅔	IV–I, 10	I, 17	40–8
5	1⅞	4⅕	6⅓	2½	V–I, 9	I, 17	40–8

The eye is greater than snout and equal to interorbital. Anterior dorsal over vent, and nearer snout than base of caudal. The two dorsals are separated by a distance equal to depth of body or twice length of eye. Anal base black. Silvery band narrow, about as wide as pupil, on the fourth row of scales in the middle of body, slightly involving the third and fifth rows. Back with a narrow stripe of small spots. Lower jaw scarcely projecting. A single specimen from Skinner Point is 2¼ inches long, and has head 4⅓, depth 5⅓, eye 3, dorsal IV–I,10, anal I,18.

26. **Pomoxis sparoides** (*Lacépède*). *Speckled perch.* (*a, b.*) Frequents same grounds as the "chub." In fall there is some angling for the fish by citizens of Edenton, minnows and grubs being the bait used.

27. **Chænobryttus gulosus** (Cuv. & Val.). *Goggle-eye.* (*a.*) Common at Edenton.

28. **Enneacanthus simulans** (*Cope*). (*a.*) Only three small specimens obtained. These have the following measurements and proportions: Length (inches), 2, 2¼, 2⅜; head, 2⅘, 2⅘, 2⅘; depth 2⅓, 2⅓, 2¼; *eye*, 3, 3, 3¼; dorsal, x,10, ix,11, ix,11; anal, iii,9, iii,11, iii,10; scales, 3-30-9, 3-29-8, 3-29-9.

29. **Lepomis auritus** (Linnæus). *Leather-ear*; *Red-belly*; *Yellow-belly.* Common up the creeks but rare in the open water of the sound.

30. **Lepomis pallidus** (Mitchill). *Blue joe.* Not uncommon in creeks near Edenton, and is a favorite fish for anglers.

31. **Lepomis gibbosus** (Linnæus). *Red-belly; Yellow-belly.* (*a, b.*) Large and small examples abundant. Occurs in sound and in creeks, and is taken in pound nets and seines. Not always distinguished by the fishermen from *L. auritus;* at least the same names are sometimes applied.

32. **Micropterus salmoides** (Lacépède). *Chub.* (*a.*) Scarce in the sound, and not often taken there by the net fishermen, but quite common in creeks and bayous. Less numerous than in the eastern end of the sound.

33. **Etheostoma nigrum olmstedi** (Storer). (*a, c.*) Very abundant at Edenton, in quiet, muddy water; 61 specimens. Rare at Skinner Point; 3 specimens. At the former station the fish were often found in shallow water among clumps of *Myriophyllum*. In all the examples examined, the opercles, cheeks, and breast are covered with scales. The features of three examples of each sex are shown in the following table:

Sex.	Length.	Head.	Depth.	Eye.	Dorsal.	Anal.	Scales.
	Inches.						
Male	2⅞	4	5⅓	3⅓	X-14	I, 8	5-52-7
Male	2¾	4	5⅓	3⅓	IX-14	I, 9	5-48-7
Male	2¾	4	5⅔	3½	IX-14	I, 9	5-51-7
Female	2⅝	4	5¼	3⅓	IX-14	I, 8	5-52-7
Female	2⅝	4	5¼	3⅓	IX-14	I, 9	5-51-7
Female	2⅝	4	5⅓	3⅓	IX-13	I, 9	5-50-7

34. **Perca flavescens** (Mitchill). *Englishman; Raccoon perch.* (*a, b.*) Examples 3 to 4 inches long very numerous about wharves. Larger fish occur in the bay, where they are taken in pound nets.

35. **Stizostedion vitreum** (Mitchill). *Pickerel.* (*b.*) A solitary fish, irregular in abundance and movements, but not especially rare. It is caught in pound nets and seines.

36. **Roccus lineatus** (Bloch). *Rock.* (*b.*) Very numerous at this time, very large examples, some weighing over 100 pounds, being taken in the dutch nets. They feed chiefly on shad and alewives and are very gluttonous.

37. **Morone americana** (Gmelin). *Perch.* (*a, c.*) Specimens about 2½ inches long very common, in company with *Querimana gyrans.*

38. **Paralichthys lethostigma** Jordan & Gilbert. *Flounder.* (*b.*) Not rare in the western end of the sound and often taken in dutch nets and seines fished for shad and alewives. Two specimens preserved are 12 and 9½ inches long, respectively, with head 3⅓ and 3¼, depth 2¼ and 2¼, gill-rakers 2-10 and 2-9.

39. **Achirus fasciatus** Lacépède. *Hog-choker.* Occurs abundantly on sandy bottom in Edenton Bay and is often taken during the shad season.

THE ROANOKE RIVER.

This is one of the longest rivers of North Carolina; it rises in the Alleghany Mountains in the southwestern part of Virginia and flows in a southeasterly direction a distance of over 300 miles, entering the western extremity of Albemarle Sound by several narrow mouths. The Roanoke in North Carolina is for the most part a swift muddy stream, carrying out into the southern half of Albemarle Sound a volume of thick yellow water which is often seen 40 miles below its mouth, contrasting strongly with the clear dark water of the northern side brought down by the Chowan. It is found that striped bass, white perch, and sturgeon prefer this muddy water and can always be taken there in greater numbers than on the northern side of the sound, where shad and alewives always occur more abundantly. The fishermen have learned by practical experience that the larger quantities of rock, sturgeon, and white perch ascend the Roanoke, while the larger run of shad and alewives is in the Chowan. The seine and other fisheries of the lower Roanoke are of considerable importance, shad, alewives, striped bass, sturgeon, catfish, suckers, perch, and a number of species of sunfishes (*Centrarchidæ*) being taken in abundance.

Collections were made at the following places in this river:

(*a*) *Plymouth and vicinity.*—The Roanoke River in the neighborhood of Plymouth is a narrow muddy stream, the shores being low, wooded with cypress, pine, and other trees, and for the most part swampy. The left bank of the river is of soft mud well overgrown with weeds. Temperature of water April 12, 56° F. Seining was done at numerous points in the following localities:

(1) About a mile below the city on the right bank of the river, on a little sandy beach. Work was here made unsatisfactory by a large quantity of driftwood in the water, a heavy wind, and high muddy water.

(2) On the mud flats opposite the city.

(3) About one mile above the city, on the right bank, at a small sandy beach fringed with bushes.

(4) Two miles above Plymouth at the entrance to Middle River, a branch which the Roanoke gives off about 8 miles from its mouth and which again joins the main river a short distance from its termination.

(*b*) *Weldon.*—This place is 130 miles from the mouth of the river, which is here a narrow rapid stream passing between precipitous banks of clay, of which color the water partakes. At the time of visit, April 13, the river was much swollen by recent rains and was exceedingly muddy. Seining could not be done in the river owing to the rapid water and the nature of the shores. A short distance below the town, however, a very small brook enters the river from the northwest, which it was possible to explore. This is apparently a spring brook, flowing between steep clay banks which are well wooded in the lower part of its course. It is nowhere more than a few feet wide and a few inches deep, except in small holes and near its mouth. This stream for a distance of half a mile was diligently seined in every hole that by any possibility could contain fish, but with only meager results. The brook abounds in crayfishes (*Cambarus blandingii acuta*), which were molting at this time; some specimens of large size were seined. Temperature of water April 13, 58° F.

In the following list the stations at which collections were made are indicated by the letters (*a* and *b*) used in the foregoing paragraphs.

FISHES OF THE ROANOKE RIVER.

1. **Acipenser sturio oxyrhynchus** (Mitchill). *Sturgeon.* (*a.*) A specimen 11½ inches long was seined 2 miles above Plymouth in the Roanoke River April 12. The fishermen at Plymouth report that young sturgeon of this size occur in the river as early as February and are taken in seines hauled for striped bass, but the adult fish do not appear until the latter part of April, after the principal run of shad is over.
2. **Amia calva** Linnaeus. *Blackfish.* (*a.*) Not uncommon in the lower course of the river near Plymouth, but less numerous than in the sound.
3. **Ameiurus albidus** (Le Sueur). *Sound cat; River cat; Creek cat; Bull-head.* (*a, b.*) Very common: examples 5 or 6 inches long exceedingly numerous and taken in large quantities in haul seines and weirs near Plymouth. The large, milky-colored examples are known among the fishermen of the lower river as "sound cats" and "bullheads," while the small, dark-colored ones are called "river cats" and "creek cats." At Weldon the fish is also common, and, according to Mr. Worth, of the U. S. Fish Commission, is caught in large numbers by anglers.
4. **Ameiurus nebulosus** (Le Sueur). *Yellow cat.* (*a.*) Less common than *A. albidus*, the proportional abundance being about as ten to one at this time.
5. **Moxostoma anisurum** (Rafinesque). *Sucking mullet.* (*a.*) An example about 8 inches long is referred to this species. It agrees very closely with the description of *M. velatum* (Cope), as given in the "Synopsis," which Prof. Jordan refers to the synonymy of *M. anisurum* in the "Manual," although the descriptions of *M. anisurum* in the "Synopsis" and the "Manual" are not applicable to the specimen under consideration. The body is rather stout, compressed, the back elevated, the depth 3½ in length. Head short, small, conic, broad and flat above, 4 in length. Mouth small, the lips plicate, the lower lip ʌ-shaped. Muzzle truncate, overhanging mouth. Eye in middle of side of head, 4 in length, ½ in snout, 1½ in interorbital. Depth of cheek one-half length of head anterior to preopercle. Dorsal fin long, with 15 developed and 2 rudimentary rays, the height of first ray equal to length of base and five-sixths length of head, the free edge straight. Caudal lobes subequal. General color silvery, dusky above, whitish below. Dorsal and caudal membranes blackish, other fins plain. Scales 6-42-5.

   Although only one specimen was preserved, numerous examples were observed at the seining beaches near Plymouth. From the other sucker obtained in this river this species was easily distinguished by the absence of dark spots at the bases of the scales and by having the dorsal margin straight. No individuals more than 10 inches long were noticed. This fish shares with the small examples of *M. crassilabre* the name "sucking mullet."
6. **Moxostoma crassilabre** (Cope). *Redhorse; Sucking mullet; Horsefish; Redfin; Mullet.* (*a, b.*) Very abundant in the lower river, where they are taken in numbers in the shad seines, the largest individuals having considerable market value. Examples from 8 to 20 inches long observed. At Plymouth the name "redhorse" is usually restricted to the largest specimens, the small ones being called "sucking mullet." At Weldon the names "mullet," "redfin," and "horsefish" are in use and are doubtless also applied to other suckers which were not detected in this inquiry. Two specimens from the Roanoke River near Plymouth are similar to the fish described from Edenton, but are smaller, being about 9 inches long. Head, 4⅓; depth, 3½; eye in head, 3½ and 4; dorsal, 12 and 13; scales, 6-42-5 and 6-44-5. General form very similar to the preceding. The square muzzle overhangs the rather large mouth, the lips of which are thick and strongly plicate, the lower truncate behind. Longest dorsal ray equals length of head and is a little longer than base of fin, the free margin rather deeply concave, but not falcate. The upper caudal lobe is somewhat the longer. Color in life, silvery, with pale pinkish or yellowish reflections, dusky above and whitish beneath. Above the lateral line nearly every scale has a dark brown spot at the base of the exposed part, this marking being most distinct on the back. The dorsal and caudal fins have a dark interradial membrane; the lower fins are pale reddish or orange. In larger individuals the coloration of the fins is more intense. In the uncertainty of the status of many species of *Moxostoma* from the South Atlantic States, the identification as *M. crassilabre* (Cope) of the small specimens at hand from the Roanoke River is not satisfactory and must be considered as only tentative.

7. **Cyprinus carpio** Linnæus. *Carp.* (*a.*) Not uncommon in the lower river, where it reaches a weight of 7 pounds.
8. **Hybognathus nuchalis** Agassiz. *Roach.* (*a.*) Very common. Eight specimens, from 2⅝ to 4¾ inches long, preserved. The intestinal tract of some of the larger examples is greatly distended with vegetable matter, giving the abdomen a swollen, distorted appearance. A dark spot at the base of caudal occurs in the smaller specimens. There is a narrow, dark vertebral band, extending from nape to caudal. Head, 4¼ to 4½; depth, 4 to 4¼; eye, 3 to 3½; scales, 5–39–4 to 5–41–4; scales before dorsal, 13 or 14; dorsal, II,7; anal, II,7.
9. **Semotilus atromaculatus** (Mitchill). (*b.*) One specimen, 1¾ inches long, showing the dark dorsal spot.
10. **Notemigonus chrysoleucus** (Mitchill). *Roach.* (*a, b.*) Abundant. Taken in large numbers with shad and alewives in the lower river, many of the fish being of large size. The specimens at hand appear to represent the typical species and not the variety ***bosci***, whose range embraces this region, the anal having 13 or 14 rays, and the scales being about 10–50–3.
11. **Clupea mediocris** Mitchill. *Hickory shad.* (*a.*) Common.
12. **Clupea pseudoharengus** Wilson. *Goggle-eye.* (*a.*) Abundant.
13. **Clupea æstivalis** Mitchill. *School herring.* (*a.*) Abundant.
14. **Clupea sapidissima** Wilson. *Shad.* (*a, b.*) Large numbers of shad ascend the Roanoke River and are taken with seines and other devices. At Weldon the fish is sometimes caught with a hook by anglers; as this is when the shad is ascending the river to spawn, the observation is contrary to the current opinion that the fish takes no food after entering the rivers.
15. **Dorosoma cepedianum** (Le Sueur). *Gizzard shad.* (*a.*) Very common.
16. **Fundulus diaphanus** (Le Sueur). (*a.*) Exceedingly abundant on mud flats opposite Plymouth. Of the 16 specimens obtained, the largest is 2 inches long. A male example, 1¾ inches long, has a small ocellus on the posterior border of the dorsal, consisting of a roundish black blotch surrounded by a pure white area; the base of the fin is white, and the remaining part dusky; head, 3½; depth, 4½; eye, 3; dorsal, 12; anal, 10; scales, 46–13.
17. **Gambusia patruelis** (Baird & Girard). (*a, b.*) Abundant at both stations.
18. **Lucius americanus** (Gmelin). ***Pike; Red-finned pike.*** (*a, b.*) One specimen from Plymouth, 5⅝ inches long; head, 3; depth, 5⅝; eye, 5½ in head, 2 in snout; dorsal, 11; anal, 11. At Weldon the fish was not observed, but was reported by the fishermen; according to Mr. S. G. Worth, of the U. S. Fish Commission, it is abundant in the Roanoke at that place, where it is known as the "red-finned pike."
19. **Lucius reticulatus** (Le Sueur). *Pike; Red-finned pike; Black pike; Jack.* (*a.*) Common. The name "black pike" is given to old, dark-colored examples which apparently frequent deep, shady holes.
20. **Anguilla chrysypa** Rafinesque. (*a, b.*) Common.
21. **Querimana gyrans** Jordan & Gilbert. (*a.*) Apparently very rare, and probably only a straggler from the sound. One specimen was obtained about a mile below Plymouth.
22. **Aphredoderus sayanus** (Gilliams). (*a.*) Apparently rare, and unknown to the fishermen. The single specimen obtained is 2⅝ inches long, with head, 3; depth, 3½; eye, 4¼; dorsal, III,11; anal, II,5; lateral line, 51. The outer parts of caudal and dorsal fins are white, the inner parts reddish purple, the color being darkest on the caudal and most intense where it joins the white border; pectorals and anal faintly spotted with purple.
23. **Centrarchus macropterus** (Lacépède). *Flier; Sunfish; Mill-pond perch.* (*a.*) Very common.
24. **Pomoxis sparoides** (Lacépède). *Speckled perch.* (*a.*) Common.
25. **Chænobryttus gulosus** (Cuv. & Val.). *Goggle-eye; Chub; Mud chub.* (*a, b.*) Abundant in the lower river, where it is caught in gill and other nets and sold for food at Plymouth and elsewhere. A single specimen, 2 inches long, was obtained at Weldon; it is marked by faint cross-bars.
26. **Enneacanthus obesus** (Baird). (*b.*) A specimen, 1¾ inches long, is referred to this species. It was taken in very muddy water, and was of a pale, olivaceous color, with about 6 indistinct, dark cross-bars. Head, 2¾; depth, 2¼; eye, 3; dorsal, IX,10; anal, III,10; scales, 5–31–10. Lateral line absent from posterior third of body.

27. **Lepomis pallidus** (Mitchill). *Blue perch.* (*b.*) Common at Weldon. Probably occurs at Plymouth, but was not detected there.

28. **Lepomis gibbosus** (Linnæus). *Robin; Yellow-belly; Red-belly.* (*a, b.*) Very common. Regularly exposed for sale in Plymouth, where it is caught in gill nets with *Centrarchus macropterus* and *Chænobryttus gulosus.*

29. **Micropterus salmoides** (Lacépède). *Chub.* (*a, b.*) Common.

30. **Etheostoma nigrum olmstedi** (Storer). (*a.*) Fourteen specimens.

31. **Perca flavescens** (Mitchill). *Raccoon perch.* (*a.*) Abundant.

32. **Stizostedion vitreum** (Mitchill). *Brook trout; Salmon.* (*a, b.*) At a seine fishery near Plymouth an example 2 feet long was seen. While not common in the river, several fish, mostly under a foot in length, are taken at nearly every haul of the large shad seines. At Weldon the fish is rare and was not observed, although it was reported by the fishermen under the name "salmon."

33. **Roccus lineatus** (Bloch). *Rock.* (*a, b.*) Very abundant during the shad season. Caught chiefly in seines, the most important fishery being about 2 miles above Plymouth. The fish ascend the river as far as the falls near Weldon, where they spawn, according to Mr. Worth.

34. **Morone americana** (Gmelin). *Perch; Silver perch.* (*a, b.*) Abundant, but less numerous than formerly in the lower river.

35. **Paralichthys lethostigma** Jordan & Gilbert. *Flounder.* (*a.*) The tendency of this species to ascend fresh-water streams has often been observed, but its occurrence so far up the muddy waters of the Roanoke River is a matter of unusual interest. The fish is said to be quite rare in the vicinity of Plymouth, 2 miles above which place, on April 8, a specimen, about 2 feet long, was taken in a seine, and on April 11 another example, 8 inches long, was obtained.

5.—OBSERVATIONS ON THE SPAWNING HABITS OF THE SHAD.

BY S. G. WORTH.

The object of this paper is to direct attention to the fact that shad (*Clupea sapidissima*), in certain river basins at least, exhibit a choice of localities in which to lay their eggs; and to point out that the areas preferred are well defined in their situation below creeks, being in the track of the currents therefrom.

The spawning-grounds of the shad are so well known that anything additional on the subject would possess little value as indicating the more remunerative localities for gathering their eggs. Discoveries in this direction would rather be of service in disclosing the spawning habits of other species less known, as, for example, the striped bass, striped mullet, and sturgeon. They might also serve a somewhat different though equally useful purpose in pointing out those areas in which necessary prohibitory measures would effect the greatest advantage.

While the claim is made that the greatest percentage of ripe shad are to be found immediately below and in the currents of creeks, it is not intended to create the impression that greater relative numbers of fish are caught at these points.

The spawning region of the shad is of large proportions, extending from the limit of the brackish water inland 50 to 100 miles or more. The fish captured anywhere in this region are liable to be ripe, and, indeed, it may be said that on one or perhaps two days in any given season ripe shad are common to all parts of the spawning region. This occurrence, however rare, has been very misleading to seine proprietors, who, hastily adopting the belief that their fisheries were valuable for the amount of eggs they would afford, were instrumental in causing many fruitless visits from spawn-takers. When we consider critically the fisheries as to their profitableness as contributors to the hatcheries, we find that the greater number are of no practical value and that many of the largest in catch are the poorest in egg-production.

The cost of shad ova on the Potomac River (including all items, as the amount paid in purchase money, salaries of experts and laborers, fuel, and transportation) is about $85 per million, which is, I believe, about the average price at the several stations of the U. S. Fish Commission. I therefore take this cost as the standard or commercial rate, and all allusions to the scarcity or abundance of eggs will be with reference to such a basis. The number of eggs obtained on the Potomac has never exceeded 81,000,000 in any one season, and the number in the two next best seasons was about 60,000,000 each (in nine years' operations). The Fort Washington seine, fished by the U. S. Fish Commission, was a large source of supply, yielding about 8 per cent of ripe fish, or at the rate of about 2,000 eggs to each fish caught, males and females combined, and was the highest producing of all the seines.* Had all other fisheries been equally productive, the annual receipts at the Fort Washington collecting station would have easily reached 300,000,000. But we find that while this seine with a catch of 10,000 fish would afford 20,000,000 eggs, and another with a catch of 18,000 fish would produce 17,000,000 eggs, a third with a catch of 60,000 fish would yield only about 1,000,000 eggs.

These inequalities in production, at fisheries near together and surrounded by the same general conditions, led to an inquiry into the underlying causes, the effects of which were so apparent. A study of the subject demonstrated that not only was the largest production of eggs derived from seines operated in river areas traversed by creek currents, but also that the most constant supplies were from those areas, and also that the eggs from those sources were better in quality (though none from the seines were so good as those from gill nets, the latter ranking highest always). It was further observed that the greatest and most invariable egg supply from gill-net fishermen was derived from nets sweeping the channel bank below creeks and in the currents of creek mouths. It is to be regretted that exact data can not be presented here in support of the belief entertained, showing in comparative tabular form the catch and egg-production of the various fisheries, but the catch was either unrecorded by fishermen or else not reported by the agents frequenting the shores and gill boats.

Before reviewing the fisheries in respect to their egg-production and relative situation to creek mouths, I would call attention to another feature of the spawning, or rather non-spawning habit of shad, viz: that there are particular stretches of river, within the spawning region, which are apparently wholly barren of ripe fish. An example of this kind is witnessed in the Roanoke River, between its mouth and Kitty-Hawk and Slade's fisheries, situated above Plymouth, North Carolina, a distance of perhaps 15 miles. Between these points 10,000 to 15,000 shad are captured annually, in six or more seines, and among them no ripe fish are found. Striped bass, too, are caught in these seines by thousands, but while they are known to spawn only a few miles below, as well as many miles above, at Weldon, none spawn here. Fairly satisfactory examinations of the shad catch on the Neuse River also, from its mouth to a distance of 16 miles above, indicates an absence of ripe fish, they being so scarce as

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*The record of operations of this seine will serve a useful purpose for comparative studies. Twenty-three per cent of the Potomac eggs have been derived from it, the numbers secured during the first four years being as follows: 1,089,000 in 1883, 6,000,000 in 1884, 7,280,000 in 1885, and 11,848,000 in 1886. The details of subsequent production are shown in the statement which follows:

Year.	Total eggs obtained.	No. of spawning fish	Per cent of spawning fish.	Total catch of adult shad.	Catch of male fish.	Catch of female fish.	Per cent of male fish.	Per cent of female fish.	Average eggs per spawning fish.	Average eggs per female caught.	Average eggs per fish caught.
1887	20,956,000	652	6.3	10,348	7,388	2,960	71.4	28.6	32,100	7,080	2,010
1888	22,657,000	688	6.1	11,212	7,760	3,552	69.2	30.8	32,900	6,380	2,020
1889	17,738,000	612	9.8	6,217	3,254	2,963	52.3	47.7	28,980	6,000	2,690
1890	10,262,000	468	10.1	4,606	2,503	2,103	54.3	45.7	21,900	4,870	2,220
1891	5,276,000	228	7.2	3,138	1,793	1,345	57.1	42.9	23,140	3,920	1,670
Annual average	15,377,000	530	7.9	7,104	4,540	2,585	60.8	39.2	27,800	5,650	2,122

to render doubtful the collection there of enough spawn to justify the establishment of an ordinary hatching station, while the large catch of fish and the natural surroundings would seem to guarantee such an investment against risk.

Albemarle production.—On the Albemarle Sound well-conducted examinations disclosed the fact that but one seine afforded a reasonably remunerative and regular supply of eggs. This was the Sutton Beach fishery (producing about 30,000 shad per season ten years ago), situated just below Salmon Creek. This creek, though it does not affect the argument, is unlike any of the others subsequently adverted to, in being above tide water and hence discharging a constant current of warmer water through the seine berth, except when occasionally shifted from its course by high winds. This shore yielded perhaps 5,000,000 eggs, a small enough number, but more than all others combined. This was the only seine operated in the influence of a creek current.

In striking contrast with this seine were four others on the east shore of the sound, between Edenton and Drummond Point, each of which caught 15,000 to 20,000 shad and produced so few eggs that they were abandoned by the spawn-takers at the expiration of the second season. In greater contrast (because situated higher up stream) were the four or more seines on the Chowan River, which, though principally alewife fisheries, made a catch of 5,000 to 10,000 shad per annum, and yet were so unproductive of eggs that they, too, were abandoned by spawn-takers. Equally unproductive were the three or more seines operated in the headwaters of Batchelor Bay by Mr. Nichols and others, as were also the Roanoke seines already referred to elsewhere.

There remains to be mentioned but one other seine in this region, that being Scotch Hall, operated near Black Walnut Point, at the confluence of Chowan River and Batchelor Bay. This seine produced a fair number of eggs, but probably there would have been none, so to speak, but for the fact that southerly and easterly winds brought the Roanoke water over to commingle with that of the Chowan, thus establishing, occasionally and for brief periods, the conditions more constantly maintained at Sutton Beach fishery by the agency of the creek current. The Chowan and Roanoke waters are essentially different in character and most probably in temperature. The spasmodic production of eggs at Scotch Hall fishery is most readily accounted for on the above conjecture.

Potomac River Production.—When we analyze the sources of production of shad eggs on the Potomac, we find, as on the Albemarle Sound, that the least variable and largest producing fisheries are coincident with the creek currents, as in the case of the Tulip Hill, Fort Washington, and Moxley Point seines, situated respectively below Broad, Swan, and Piscataway creeks.

In the case of the great seine at Stony Point we observe the reverse conditions, viz: a small and irregular egg supply and the absence of a creek current. The catch at this fishery is double that of the other three combined, while its egg product is only one-thirtieth (though the discrepancy in egg-production would be slightly less were it possible to have this seine landed every day about the sunset or spawning hour). Moreover the eggs obtained here present a very unfavorable characteristic (and one unknown at the three previously named shores) in that more than half of them, though to all external appearance good, are dead. This feature has proven embarrassing to government agents collecting them and to the proprietor whose expectations were invariably disappointed when the daily returns were sent him.

Along with this seine we find that Ferry Landing, not in a creek current, produced a relatively small number of eggs, which, though of more even occurrence, were worse in quality than those from Stony Point seine, the larger part being found dead soon after their introduction into the developing jars. The catch by this fishery was almost equal to the aggregate of Tulip Hill, Fort Washington, and Moxley Point seines, while its egg product was perhaps 15 times less. Little Hunting Creek, discharging into the river more than a mile above, probably has no tempering effect on this seine berth. In fact, the water in this berth, as well as in that swept by Stony Point seine, is probably already too warm, since both are on the flats.

Of the three remaining seines but two will be referred to in this immediate connection, Chapman Point seine ranking fourth in number, regularity, and quality of eggs. It is situated below Pomunky Creek, but this is a feeble stream and rather remotely situated to afford the constant effect produced by Broad, Swan, and Piscataway creeks, which are either of greater volume or in closer proximity to the three seines of most remunerative supply.

Pomunky seine, formerly visited by spawn-takers, is situated immediately above the mouth of a creek of the same name. It had no importance as a spawn-producing fishery.

In the following table will be found a fair comparative statement of the Potomac River shad-egg production, 1888–1891, with reference to the influence of creeks thereon:

Fishery.	No. of seasons covered.	Average annual egg production.	Largest annual egg production for the period.	Estimated annual average shad catch for period.	Average annual receipts from the four largest producing boats.
Seines:					
Fort Washington	4	13,999,000	22,657,000	*6,000	....
Moxley Point	2	13,903,000	18,828,000	*15,000	....
Tulip Hill	4	3,477,000	4,231,000	*4,000	....
Chapman Point	5	2,771,000	6,834,000	*15,000	....
Ferry Landing	2	1,983,000	2,250,000	†20,000	....
Stony Point	2	952,000	1,067,000	†45,000	....
Gill fishermen:		(per boat)	(per boat)		
Fort Washington to Bryan Point	2	1,083,000	*3,495,000	....	8,229,000
White House	2	417,000	*1,453,000	....	4,425,000
Sandy Bar	2	347,000	†1,198,000	....	2,759,000
Greenway	1	313,000	†1,341,000	....	2,213,000
Craney Island	1	151,000	†414,000	....	944,000

* Below creeks. † Not below creeks.

Delaware River Production.—On the Delaware but two of the six or more large seines situated on the New Jersey shore between Gloucester City and Billingsport have attained high rank in consequence of the egg yield. These are Howell Cove (operated immediately below the mouth of Big Timber Creek) and Faunce's, below Woodbury Creek, the other shores not being so situated as to creek mouths. In 1890 the egg-production by the Delaware seines was as follows:

Howell Cove	24,653,000
Faunce's Fishery	12,318,000
Gloucester Point	2,518,000
Rice's Fishery	922,000

Another seine, operated just below Oldman Creek, appears, in consequence of its detached situation, to have been passed over by spawn-collectors, and we have no data relating thereto. If this seine is not wholly without the spawning region by virtue of its seaward location, it will doubtless be found very productive of spawn and, should this prove to be the case, will probably afford the choicest site on the Delaware for a permanent shad station.

The Potency of Creeks.—That the higher temperature of the creek water is chiefly the controlling factor in drawing shad to these localities to spawn, I have no reasonable doubt. That the creek water, as a separate volume, is itself preferred as an element to spawn in, is evidently not the case; for observation on the catch of the seine operated by the Raum family in Broad Creek proper (2 miles above Fort Washington station, Potomac river) shows that this fishery possesses no value as an instrument of egg-production. Apparently the warmer water of the creeks becomes an active influence only when commingling with the colder river volume, or when effecting a mean between the two extremes in temperature. How far bottom may exert an influence I am unable to judge; it is not impossible that a greater amount of sand and gravel distributed over these areas by the creeks gives them a somewhat preferred character, but I do not think that this feature enters into the question except in a minor way, if at all.

Commissioner McDonald has pointed out that shad are controlled by temperature, they being always found within given limits of heat and cold; that they enter the estuaries as soon as these waters become warmer than that of the ocean, and that they ascend the fresh-water streams in quest of the higher zone of heat, the mean temperature sought being about 60° F. Now, since they spawn about or soon after the sunset hour (between the hours of 5 and 10 p. m.), it becomes evident that they prefer, for this act, neither the highest nor the lowest temperature of the 24-hour period, for the highest degree prevails earlier in the afternoon on the flats and in the creeks, while the lowest is existent in the early morning.

The fact that spawning shad caught in the warmer water on wide flats remote from the river channel are unaccompanied by sufficient bucks to afford milt for impregnating their eggs suggests that these localities are abnormal for spawning. It is possible, but rather improbable, that sufficient bucks do accompany the females, but, owing to their smaller size, escape the meshes of the gill nets.

On the other hand the spawning between midnight and noon, or in the coldest water of the 24-hour period, is very light. Experience satisfies me that even the low production by the Fort Washington seine is greater than at other fisheries (see two years' record of this seine below):

Year.	A. M. (12 o'clock midnight to 12 o'clock meridian) eggs.	P. M. (12 o'clock meridian to 12 o'clock midnight) eggs.	Total eggs.	Percentage of A. M. eggs.	Percentage of P. M. eggs.
1887	*3, 095, 000	17, 861, 000	20, 956, 000	14	86
1888	†1, 858, 000	20, 799, 000	22, 657, 000	8	92

* Taken during 19 days, April 16 to May 23.

† Taken during 16 days, April 16 to May 26.

I therefore conclude that shad choose (or are impelled) to lay their eggs in the highest daily average temperature, a condition which would be realized about or soon after sunset, when the warmer water of the flats is intermingling with the colder channel water and establishing a balance. This suggestion is supported by the fact (at least on the Albemarle Sound and Potomac River) that the greatest number of ripe shad are taken off the edges of the channels.

It is but a step further to infer that fish so sensitively organized as to recognize the highest average of heat on its daily recurrence would readily perceive those tempered areas below creeks, which are relatively warmer. It is not impossible that they would detect an increase in heat here so slight that the ordinary thermometer would fail to record the advance. The air temperature during the run of the shad being on the increase, the creeks are naturally warmer than the river channels. The degree of heat increases from that of frosty mornings in the springtime to the hot days of June, or the time when tree foliage is full grown. The creeks, being sheltered from winds, absorb the sun's direct rays in a relatively greater ratio than the deeper waters of the river proper. The heat is imparted to the water volumes of the creeks on the flood tide and to their mud flats (and conserved) on the ebb tide.

Let the cause be what it may, it can not be denied that those river areas which are traversed by creek currents are the fields of preëminent adaptation for the natural spawning of shad.

The reason for not attempting an application of my observations to the Susquehanna spawning-grounds is that I am less familiar with the localities and have not made full studies of the charts in relation to the recorded receipts of eggs, the details of which form no part of the general office files at Washington. Apparently the large egg-production there (equal or perhaps superior to the amount obtained on any other of the rivers named) is in no way dependent upon creek currents. Since, however, the largest and most regular production of eggs on the Potomac is derived from the gill nets which are operated below and in the currents of creeks, viz, those at Moxley Point and White House, I can but infer that similar relative conditions are in force on the Susquehanna to effect such a great yield of eggs from the gill boats there. That the colder water in the channels and the warmer water on the contiguous flats or bars afford there the corresponding conditions seems altogether probable. The water from the two areas, commingling by gravity in the early part of the night would undoubtedly establish at about that time the temperature of highest daily average. The numerous deep channels and vast expanses of flats seem to be sufficient to account for the large egg-production below Havre de Grace.

6.—A PRELIMINARY REPORT ON THE AQUATIC INVERTEBRATE FAUNA OF THE YELLOWSTONE NATIONAL PARK, WYOMING, AND OF THE FLATHEAD REGION OF MONTANA.

BY S. A. FORBES,
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INTRODUCTORY.

The immediate impulse to the investigation of the aquatic invertebrate fauna of Wyoming and Montana, here reported in a preliminary way, was supplied by the ichthyological work of Dr. David S. Jordan, in the Yellowstone National Park, in 1889, and of Prof. B. W. Evermann, in Montana and Wyoming, in 1891.

The waters of Yellowstone Park had been reconnoitered by Dr. Jordan for the special purpose of ascertaining precisely which of them were destitute of fish and what was the cause of their barrenness. This having proved to be topographical in every case—some physical barrier to the entrance of fishes from below—it seemed possible to stock these waters permanently with valuable game-fishes, and thus greatly to increase the attractiveness of the Park to a considerable class of travelers. Preliminary to this, however, it was evidently desirable that a full knowledge should be had of the variety and abundance of the lower animal life of these fishless waters, since upon this the fishes introduced must chiefly depend for food. To this practical end it was the wish of Hon. Marshall McDonald, United States Commissioner of Fish and Fisheries, that my own investigations made in 1890 should be immediately directed; but with the understanding that the opportunity thus afforded for a general zoölogical survey of the waters of Yellowstone Park should be improved to the best of my ability.

My associate in 1890 was Prof. Edwin Linton, of Washington and Jefferson College, Pennsylvania, who, although specially charged with another duty, that of a study of the parasites of fishes in these waters, rendered me constant and invaluable service in my own special field.

In 1891 it was my general purpose to coöperate with Prof. Evermann in an exploration of the waters of Montana and Wyoming, to be made with reference to the location of a fish-hatchery; but in this, as in the preceding year, I made every effort to become as thoroughly acquainted with the animal life of the waters which I examined as the brief time spent in each locality would permit.

TRIP OF 1890.

Leaving the University of Illinois July 11, I was joined in Chicago by Prof. Linton July 14, having spent the interval in supplying deficiencies in our outfit. We left Chicago on the evening of the 14th, reached Mammoth Hot Springs, in Yellowstone National Park, via the Northern Pacific Railroad from St. Paul, during the afternoon of July 17, and went into camp the same evening on Swan Lake Plateau, with everything ready for the field. Our party at starting consisted of Prof. Linton and myself, our guide, Mr. Elwood Hofer, who had made our camp ready in advance, and a teamster, two packers, and a cook. Our outfit contained (besides the necessary camp equipage) pack animals and saddle horses for six men, a portable canvas boat with two pairs of oars, two naturalist's dredges with rope, a set of portable sieves for assorting the contents of the dredges, a sounding line, a very deep trammel net 50 yards long, a creek seine, an ordinary minnow seine, a Baird collecting seine, surface nets, hand nets, two deep-sea thermometers, a dissecting microscope, a compound microscope with complete equipment for field microscopy and for the preservation of perishable minute material, tanks of alcohol, bottles, vials, etc.

Breaking camp on the morning of July 18, we rode 25 miles through Norris Geyser Basin and down the Gibbon River to the branch of the latter known as Canyon Creek, where we camped for the night and made our first collections with hand nets from that stream. On the 19th we rode through the lower and upper geyser basins and camped just beyond the latter, on the banks of the Firehole River.

Collections with hand and surface nets were made here from various points on the Firehole and from the outlet of a warm spring on its banks. As we were now to travel for some weeks by mountain trails, the teamster was here turned back, and the pack animals were loaded for the trip across the "continental divide." Leaving this camp on July 20, we crossed the divide through Norris Pass and went into camp on the shore of the north end of Shoshone Lake, at the mouth of Heron Creek. A hurried dip with surface nets was made, in passing, into the waters of some large ponds, without outlet, in the mountains near the summit of the divide.

On Shoshone Lake we stayed for the three days following (two of the party circumnavigating it on the 22d), and made extensive collections along shore, in the inlet of the lake, in an overflow lagoon or pond beside it, and from its own waters with towing net and dredge, from the surface by day and night, and from the bottom at depths varying from 8 to 40 feet. Breaking camp on this lovely lake, which will ever have a peculiar charm in our memories as the place where systematic work on the invertebrate life of the waters of the Park began, we went on the morning of the 24th to Lewis Lake, 12 miles below, two of the party running the rapids of Lewis River in the boat. We camped on the east shore of Lewis Lake, working July 24 and 25 with dredge and small nets in the lake, and making miscellaneous collections from streams of various temperatures and from the waters of a swamp which becomes connected with the lake in spring.

From Lewis Lake we rode to Heart Lake, a distance of 7 or 8 miles along the foot of the Red Mountains. Arriving at noon of the 26th, we crossed Witch Creek and camped in a grove of pines above its mouth, not far from the foot of Mount Sheridan, whose precipitous front was a maze of roaring streams supplied by the melting snows on its upper slopes. The situation here is one of the most attractive in the Park. Camping ground and feed are good, water is abundant and excellent, fish of three kinds—trout, chub, and sucker—are plenty in the lake, and minnows can be taken by the half bushel in the warm waters of Witch Creek. The place is absolutely retired (there was not even a trail by the way we came) and quite off any line of travel even proposed by the Park authorities. The lake is a gem of beauty, a fit companion to the noble mountain, from whose heights a view of lakes and rivers and mountain peaks and ranges may be had second to none in this part of the Rocky Mountains.

Our stay in this charming spot extended to nearly five days, all of which but one were spent in continuous collecting from the lake and from the tributary already mentioned as Witch Creek. Violent winds made it difficult to work far from shore in our light canvas boat, but, with the aid of a small raft made for the occasion, we got good soundings and dredged successfully about a quarter of a mile out. Here, besides the kinds of collecting already specified, we used our small seine in Witch Creek and the trammel net in the lake, taking in the latter considerable quantities of all the larger kinds of fish the lake supports, in places where the rocky bottom would have made seining impossible even with a much more cumbrous apparatus.

We shifted camp on July 31 to the west bay of Yellowstone Lake, passing Riddle Lake on our way and pitching our tents on the shore, a few rods above the Upper Geyser Basin of this bay. Here a line of soundings was run out about 2,000 feet, the dredge was hauled from the boat 1,000 feet from shore at a depth of 102 feet, with a bottom temperature of 46°, and at various lesser depths near shore. Other collections were made from the lake in the usual variety, and also from several of the warm springs and their outlets. The first water birds were shot here for a study (by Prof. Linton) of the relations of the fish-eating birds to the parasitism of the trout, and descriptions were made of rotifers and protozoa which it was not possible to preserve for later study. A short excursion from this camp gave us access with the boat and our lighter apparatus to Duck Lake, a land-locked body of water, formerly connected with Yellowstone Lake, but having now neither inlet nor outlet at any season of the year. At the foot of Yellowstone Lake, where we arrived August 5, our party was reorganized by the dismissal of the guide and pack train and the engagement of a teamster and saddle horses for the remainder of the trip.

From this point we worked on the lower lake, on Yellowstone River at the outlet, and on Pelican Creek and smaller tributaries, until the 12th of August, Prof. Linton going for pelican to the head of the lake, in a skiff, on the 9th and 10th, with a volunteer party from the lake hotel. Towing-net collections were made by this party not far from the inlet. The dredge was run from a skiff off the landing, on this visit, at a depth of 100 feet, and also in shallower water. Being unable to reach deeper water for want of a line left at Norris Geyser Basin, and needing also other supplies left there, for which I was unable to get transportation to the lake, we left the lake for a time, starting to Norris Basin on the 12th. The 13th was spent at the Trout Creek camp, collecting in waters of various temperatures from Alum Creek, above and below the remarkable hot-spring basin through which this stream flows.

The occurrence of small trout in the upper course of this little creek seemed at first a mystery, since they are found above the hot springs which boil up in its bed for a distance of several rods, and so make its waters there altogether intolerable to fish; but it finally appeared that when the streams are filled by melting snow in spring and early summer the temperature is so reduced even in its lowest part as to make it possible for fish to pass.

On the 13th we transported our boat for a few hours' work on Mary Lake, a clear and pretty sheet of water lying near the summit of Mary Hill at an elevation of 8,200 feet, and we thoroughly examined also the upper waters of Nez Percé Creek as we passed down the stream to the Lower Geyser Basin. The 14th we spent in collecting from the lower part of Nez Percé Creek and from the Magpie, its principal affluent, for a short distance above its mouth. Every condition was found suitable in these streams for the maintenance of fish, and a report to the Commissioner from the field to this effect was followed by a consignment of Von Behr trout, set free in the Nez Percé by Mr. Lucas, of the Commission.

August 15 was spent on the Firehole River, from the mouth of the Nez Percé to the junction of the Firehole and the Gibbon, and the 16th on the same stream above the Lower Geyser Basin, our collections ranging from the ford above Old Faithful to the Middle Geyser Basin below the Excelsior Geyser. Excellent opportunities were given here for a study of the effects of the geyser outflow on the animal life of the stream. Some hauls along shore with the surface net were made, in passing, from Goose Lake, near the lower basin.

On the 17th we collected at Cañon Creek again, and from the Gibbon River, at the mouth of this creek, and also above and below the falls of the Gibbon, well known as an impassable barrier to the movement of fishes up this stream. In our collections above and below falls in these rivers and creeks, it was my object to learn whether any other animal inhabitants of these streams were similarly excluded from their upper waters.

On the 20th we made a trip from Norris Geyser Basin to the Twin Lakes (in one of which whitefish had already been planted by a Fish Commission party), returning by a small lakelet without outlet, called the Lake of the Woods. We went thence to the Grand Cañon, collecting by the way from the Gibbon above Virginia Cascade, and from minor waters passed, and on the 22d made a trip to a lake nameless to the guides, but marked Grebe Lake by the geologists, and mapped as the source of the Gibbon. We carried boat, dredge, small seines, and our lighter collecting apparatus to this lake, and thoroughly overhauled it, as typical of its kind.

Returning to Yellowstone Lake on the 23d, we explored Pelican Creek on the 24th for several miles above its mouth, and on the 25th dredged from two rowboats at a depth of 195 feet, with a bottom temperature of 42.5°. Returning next day to the cañon, we collected from the lower course of Alum Creek, the upper part having been explored by us previously. On the 27th, sending the wagon to Mammoth Hot Springs by the traveled road, Prof. Linton and I took the trail down the river to Yancey's Ranch, crossing Mount Washburn, and making considerable collections from Tower Creek above the fall. On the 28th we went from Yancey's to the springs, stopping by the way at Lava Creek and Blacktail Deer Creek. On the 29th the usual collections were made from the Madison, at the crossing of the Cooke City road, and also from Swan Lake on the plateau of the same name, to which our boat and the usual collecting equipment were transported for us by Capt. Boutelle, U. S. A., acting superintendent of the Park.

On August 30 we closed the field work of this trip with collections from Glen Creek below the falls, from the Gardiner River at the mouth of Hot Creek, near Mammoth Hot Springs, and from a small lakelet among the hills, towards Gardiner.

The accumulations of the trip were made under 387 collection numbers, representing 43 localities.

Our work was limited substantially to the central park plateau, only that about Mammoth Hot Springs passing beyond the lava formations which cover the plateau everywhere to an unknown depth and noticeably affect, as we discovered, the animal life of its waters. The river systems investigated were those of the Gardiner, the Madison, and the Yellowstone, on the Atlantic side of the "continental divide," and of the Snake on the Pacific slope. The principal fishless waters examined were Shoshone and Lewis lakes, the Upper Gibbon and connected waters, the Firehole and its branches, Goose Lake, Twin Lakes, Swan Lake, and Tower Creek. The effects of geyser and hot-spring outflow were shown especially by collections made from the Firehole and from Alum Creek; and those of the occurrence of falls in the course of these mountain streams were shown especially by collections from the Gibbon and some of its tributaries. The highest elevation represented by our aquatic material was that of Mary Lake (8,200 feet) and that of a small lakelet near Norris Pass, not far from the same level. The greatest depth at which we dredged was 195 feet in Yellowstone Lake, although this depth was exceeded somewhat in the work of the following year. The altitude of this lake is 7,740 feet above the sea.

As material for a study of variations in biological condition, we obtained an abundance of specimens for a comparison of the system of life in lakes, ponds, rivers, and creeks where no fish are found with those in which only a single species occurs, and with those supporting from three to eight kinds of fishes.

The effect of the "continental divide" or watershed upon the distribution of aquatic animals is, of course, amply illustrated by our material; and this, taken in connection with materials gathered the following year from lower altitudes, should show something of the limitation of range of several species imposed by differences of elevation and the like. The influence of widely different geological conditions should likewise become manifest as we compare the animals of the waters of the Park plateau with those outside.

My warmest thanks are due to Capt. F. A. Boutelle, acting superintendent of the Park, who encouraged and aided our investigations in every possible way, and to our guide, Mr. Elwood Hofer, whose tireless energy and active personal interest in our operations were greatly in our favor. He was not only the guide and manager of our movements, but a most efficient volunteer assistant in camp and in the field.

TRIP OF 1891.

Leaving Champaign, Illinois, accompanied by my university assistant, Mr. H. S. Brode, on the afternoon of August 10, I arrived at Livingston, Montana, on the evening of the 13th, by way of Chicago and St. Paul, and proceeded thence to Helena, to which place our outfit had been shipped from Washington and Champaign. Delay in the arrival of part of the equipment made field work impracticable until the afternoon of the 17th, when we made our first collections from the Jocko River at Ravalli, on the Northern Pacific Railroad in western Montana.

My immediate object on this part of our trip was an investigation of Flathead Lake and its tributaries, and among these especially a small, very cold trout stream previously visited by Prof. Evermann, and noted as suitable for the supply of the proposed trout hatchery.

Flathead Lake itself offered a very interesting contrast to Yellowstone Lake, examined the year preceding, but with sufficient resemblance also to make comparison instructive. It was then commonly reached by stage from Ravalli through the Flathead reservation—a trip which we took on August 18, going thence by steamer to Demersville on Flathead River, about 25 miles above the lake. We began our collections from this river on the evening of the same day, and worked here also on the 19th, collecting especially from bayous and backwaters. Through the kindness of Mr. H. W. Parchen, president of the Helena Board of Trade, and of his associates in a game and fishing club, I had the use of a small steam launch for the work on the lake—an indispensable advantage, without which we could have done only a little imperfect alongshore work. Accepting the cordial invitation of this club to make their club house our headquarters, we went thither from Demersville in the launch August 20, and made our first surface-net collections in the afternoon of the same day. This club house is built upon a large bay at the upper end of the lake, partially sheltered from the rather violent winds prevailing, and yet containing water of sufficient depth to illustrate fairly the deep-water conditions of this lake. It represented also every variety of shore and bottom—sandy flats, weedy shallows, rocky shores, and gravelly banks—and had the further advantage, for our purpose, of giving ready access to a considerable tributary of the lake, named Swan River on the map, but locally known as the "Big Fork." Our collections here continued over the three following days, and included surface-net work of all varieties, many alongshore collections, and several hauls with the dredge, made by aid of the launch, in water ranging from 80 to 162 feet in depth. Considerable collections were also made on Swan River, especially upon the rocky rapids a short distance above its mouth.

On the 24th we made a horseback trip to Swan Lake, 12 miles above our quarters, and spent several hours collecting with our smaller apparatus from the lower part of that lake and from a cold trout stream emptying into the river a short distance below.

On the 25th we went by the regular steamer to the foot of Flathead Lake, where we made such collections from this shallow southern end of the lake and from its outlet (the Cœur d'Alene) as a heavy storm would permit, finishing our work in this region on the 26th, and starting for Helena and Yellowstone Park. Our work in the Park was confined to the northeastern part—not visited in 1890—and to Yellowstone Lake, to which I went especially for a more thorough use of the dredge (with the aid of the passenger steamer) than I could make from skiffs the year preceding.

From Yancey's Ranch, which we reached on the 29th, we explored Slough Creek above the lower rapids, and some alkaline ponds near Baronette's Bridge, and on the 31st went up the East Fork of the Yellowstone to Soda Butte Station on the creek of the same name. Collections were made on the way from Amethyst Creek, and from the East Fork of the Yellowstone, where this creek empties into it. September 1 we spent near Soda Butte Station, at work in the creek and in Trout Lake 2 miles north of the "station." Returning to Yancey's September 2, we examined the overflow waters of the creek and searched the East Fork thoroughly at the Soda Butte bridge, and finished our collections from the river in that vicinity.

On the 3d and 4th we continued to the cañon and to the lake. The 5th was spent in making shore collections from Stevenson Island in Yellowstone Lake and in an examination of the small ponds and bayous of the island itself. On the forenoon of the 7th we finished our work on Yellowstone Lake by making three hauls of the dredge from the little steamer *Zillah* in the vicinity of Stevenson Island, at depths varying from 20 to 198 feet.

The work of the season closed, September 10, with collections made from two localities previously examined by Prof. Evermann with reference to establishing a fish-hatchery—Bridger Creek and a cold spring adjacent, near Bozeman, and some springs and small streams near Boteler's Ranch, just north of the Park. The return trip was made by the Northern Pacific Railroad, September 10 to 13.

The collections of this summer were made under 73 collection numbers, representing 23 localities.

Apart from the practical points aimed at, and the opportunity to further extend our knowledge of the aquatic life of Yellowstone Park, a region whose zoölogy must long have an exceptional interest, I value the results of this year's work chiefly as affording the means for a comparison of the animal life of two lakes so similar in many respects as Flathead and Yellowstone, and yet widely contrasted in altitude, in geological surroundings, and in topographical and geographical relations. It is, in my judgment, by a thorough examination and critical comparison of typical situations like these that the most interesting and immediately fruitful additions to zoölogical science are to be made in this field. I have only to wish that a longer stay on each of these lakes might have made possible a more minute and exhaustive study of their animal life and its relations to varying conditions of depth, bottom, temperature, season, weather, bionomic association, and the like.

DISCUSSION OF THE COLLECTIONS.

While the partial and, in most cases, merely preliminary way in which the material of these expeditions has as yet been studied makes any full discussion of the results impossible, it seems best that a report of progress should be made, presenting a summary review of the invertebrate life of these waters in the midsummer season, with descriptions or determinations of such new or particularly abundant and important kinds as have thus far been made out. Such a statement will include, in fact, the greater part of the economic results of immediate utility, and may be said, therefore, to fulfill the leading object of the work. This report may be most conveniently cast in geographical form, the life of each river system being separately discussed; but, for want of time to examine the entire mass of the collections, only a preliminary account of the fauna of the still waters visited, from temporary pools to Flathead and Yellowstone lakes, will be given at present.

The systems to which the various waters examined belong are those of Snake River and the Columbia on the Pacific slope, and of the Yellowstone and the upper Missouri on the Atlantic slope. The first is represented by collections made in the southwest part of Yellowstone Park, the second by those from the Flathead region, the third from the north and eastern parts of the Park and from the vicinity of Boteler's Ranch, and the fourth by those from the branches of the Madison in the central-western part, and from Bridger Creek near Bozeman.

The collections now reported were made from the waters named in the following list: A mountain pond near Norris Pass, Shoshone Lake, Lewis Lake, Heart Lake, Yellowstone Lake and certain of its tributary waters, Duck Lake (near the Yellowstone), Mary Lake, Goose Lake, Twin Lakes, Lake of the Woods, Grebe Lake (at the head of Gibbon River), Swan Lake (Yellowstone Park), a lakelet near Mammoth Hot Springs, Trout Lake (near Soda Butte), small ponds in the Soda Butte bottoms, alkaline ponds near Baronette's bridge and several other scattered ponds, Flathead Lake, and Swan Lake (Montana).

THE SNAKE RIVER SYSTEM.

This system was reached only in its head waters, all a few miles from the low "continental divide," which sometimes separates only imperfectly the waters of the Pacific side of the continent from those of the Atlantic slope. Shoshone and Lewis lakes of this system are, respectively, about 1½ and 2 miles in a direct line beyond the crest of the divide, and Heart Lake is less than 4. From these lakes and from their tributaries all the collections made in this district were obtained, with the exception of a little group snatched with the hand net, while the pack train was passing, from a mountain pond near Norris Pass, on the Shoshone trail.

This pond was completely stagnant and filled with growing vegetation (including filamentous and gelatinous algæ) and fallen timber. The collection contains little to indicate the elevation from which it came, but is of interest in comparison with the contents of the very different waters of Shoshone Lake a few miles away and 400 feet below. In this pond I found a small spotted larval salamander, with both fore and hind legs already budded out, a considerable number of young insects (*Corisa*, *Chironomus*, and *Corethra*—larva and pupa), an amphipod crustacean (*Allorchestes dentata*), and a great number of entomostraca. Among the latter were *Diaptomus shoshone*,* two species of *Cyclops*, *Daphnia pulex*, an undetermined species of *Daphnia*, and a *Ceriodaphnia*. A black springtail (*Poduridæ*) and a wheel animalcule (*Lacinularia socialis*), occurring abundantly in globular colonies, were the only other animals recognized in this preliminary examination.

Shoshone Lake.—Shoshone Lake is a lovely little body of clear blue water lying at the level of 7,740 feet—almost exactly that of Yellowstone Lake. It is shaped like a blotted T, with the stem, 7 miles long, extending north of east from the Geyser Basin, at the head of the lake, and the crosspiece, at the eastern end, about 4 miles in length. The stem reaches a width of 1¾ miles, but narrows near the middle of the length of the lake to less than half a mile. This lake lies charmingly secluded in a hollow of the densely wooded mountains which surround it everywhere except to the southeast. It is at present accessible only by mountain trail from the Upper Geyser Basin, and has fortunately been omitted from the system of improved roads now being made for wagon travel. The shores are bold but not much broken, steepest on the south and west, where the 8,000-foot line runs a quarter to half a mile from the margin of the lake. On the northeast a peak about half a mile back rises to 8,600 feet, and others nearly as high lie not far north of the eastern end. To the south the Pitchstone Plateau lifts its black and forbidding mass—patched with snow all summer—to a height of nearly 9,000 feet; and to the southeast, 7 or 8 miles away, but seemingly less than half as far, the Red Mountains rise, culminating in Mount Sheridan, 10,200 feet above the sea. The rampart of hills surrounding the lake opens out on the northeast, where Heron Creek comes in; on the west, to form the valley of Shoshone Creek; on the south, where Moose Creek drains a swampy tract about 1 mile across and 5 miles long; and on the southeast, where the waters of the lake pass out through Lewis River. Some smaller tributaries empty at the Geyser Basin, on the eastern end; and a number of little rivulets, dry at times, drain the hills at various points. Near the mouths of the larger streams, ponds or small lagoons occur, connected with the lake at high water, and in midsummer thick with vegetation and swarming with animal life. The immediate shores are commonly rocky except for an occasional narrow beach of black volcanic gravel. There is little weedy water in this lake, the sandy bottom bearing at best a sparse growth of *Potamogeton* and plants of similar habit.

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* Described on page 251.

The only soundings made by us were in the north arm or bay of the lake, where depths of 40 and 50 feet were reached from a third to half way across the mouth of this bay, starting from the eastern side. The bottom at these depths varied from sand to soft mud, the latter without vegetation, the former with a growth of *Cladophora.*

Our camp was placed in a small grove on the flat at the mouth of Heron Creek, where we had at hand the creek itself and a small, very weedy, and very muddy lagoon, filled earlier with overflow waters, but then disconnected from the lake. Our collections were made chiefly in the north bay of the lake, but a few things were taken from the western end, and a few collected alongshore as we made our way to the outlet. In the north bay, besides making collections along shore and with hand nets in the shallow water, we hauled the surface net repeatedly from the boat, from 8 a. m. to 9 p. m., in both clear and rainy weather, and dredged at various depths from 6 to 40 feet. Our larger apparatus was useless, as there were no fish in this lake.*

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* Here we first heard, while out on the lake in the bright still morning, the mysterious aërial sound for which this region is noted. It put me in mind of the vibrating clang of a harp lightly and rapidly touched high up above the tree tops, or the sound of many telegraph wires swinging regularly and rapidly in the wind, or, more rarely, of faintly-heard voices answering each other overhead. It begins softly in the remote distance, draws rapidly near with louder and louder throbs of sound, and dies away in the opposite distance; or it may seem to wander irregularly about, the whole passage lasting from a few seconds to half a minute or more. We heard it repeatedly and very distinctly here and at Yellowstone Lake, most frequently at the latter place. It is usually noticed on still, bright mornings not long after sunrise, and it is always louder at this time of day; but I heard it clearly, though faintly, once at noon when a stiff breeze was blowing. No scientific explanation of this really bewitching phenomenon has ever been published, although it has been several times referred to by travelers, who have ventured various crude guesses at its cause, varying from that commonest catch-all of the ignorant, "electricity," to the whistling of the wings of ducks and the noise of the "steamboat geyser." It seems to me to belong to the class of aërial echoes, but even on that supposition I can not account for the origin of the sound.

The assemblage of animals in this lake offered a peculiarly interesting subject of study, since it included practically no aquatic vertebrates. There were, of course, no fishes at all; we saw no turtles or water snakes, but a single frog, and only one small salamander. The dominant groups were insect larvæ, leeches, amphipod crustaceans, and entomostraca. By far the most abundant aquatic insects were caseworms (larval *Phryganeidæ*), mostly pupæ at the time of our visit. There were no crayfishes and no isopod or phyllopod crustaceans; but two amphipod genera (*Gammarus* and *Allorchestes*) were very abundant. The *Gammari*, represented by a single large and robust species (*Gammarus robustus* Sm.), were exceedingly common, creeping or swimming about, on or near the bottom, inshore, especially where collections of débris from the inlet rested in hollows of the rippled sand. They sometimes rose to the surface at night, where our towing net occasionally took a surprising number of them—at one haul almost nothing else. They occurred also abundantly in our deepest dredgings, in the lagoons examined and in the streams flowing into the lake.

This lake seemed, indeed, a paradise for the *Gammari*, containing an abundance of food for them, both animal and vegetable, fresh and in process of decay, and scarcely anything that fed upon them in turn. The commonest large leech (*Nephelis obscura*, var. *maculata*) feeds upon them to some extent, as I found by the dissection of two specimens; but another of these leeches voided a large horse-fly larva (*Tabanus*). Their own food, if I may judge from that of seven specimens which I dissected, is quite varied, consisting of rotting vegetation (whose condition was shown by the mycelial threads running through it), of fresh algæ, and other green-plant substance, and of entomostraca (*Diaptomi* as far as seen). The stomachs of three contained, also, a noticeable amount of pollen grains of the pine. In three of the seven specimens examined large numbers of *Gregarinæ* infested the intestine. Their probable effect was shown by the fact that the intestine was empty in two of the parasitized specimens. Our *Gammarus* was thus practically at the head of the biological system of this lake, which was for it a royal domain where it was free to exact tribute of all, yielding scarcely anything itself in turn. The females at this time had their brood cavities loaded with young.

The entomostraca were principally a single species of copepod—a very large blood-red *Diaptomus*, new to science and here described as *D. shoshone*. This occurred in great numbers in several hauls with the surface net, and could usually be seen on a calm evening near the surface, where its tiny sportive leaps in the air kept the water microscopically agitated, as if by minute fish. Another *Diaptomus*, near *D. sicilis* and perhaps a variety of that species, occurred much more sparingly, and a third species of this genus, described on p. 252 as *D. lintoni*, was less frequently seen than either of the foregoing. There were a few species of *Cyclops* here, *C. serrulatus* Koch, *C. gyrinus* Forbes, *C. minnilus* (new), and perhaps others; also, a *Cypris*, a *Bosmina*, a *Chydorus*, a *Daphnia* (*D. pulex*), and *Polyphemus pediculus*. So far as the crustacea were concerned, the lake was in practical possession of *Gammarus robustus* and *Diaptomus shoshone*.

The food of the latter little species was peculiar at the time of my visit, and the collections consequently give little idea of its usual function in the biological system of the lake. All of more than fifty specimens examined from several of the Shoshone Lake collections had fed freely, and often greedily, on the pollen grains of the pine. Only a single specimen dissected contained also some fragments of another entomostracan, among which were single antennal segments of a copepod, probably of its own species.

This fact is but an illustration of the dependence of the animals of a lake on the contributions made to its stores of food by the surrounding land. As a surprising number of fishes profit largely by the terrestial insects falling into the water, so this little copepod horde must live for some weeks, to a very large extent, on the pollen of the surrounding forest, relaxing the pressure, for a time, on the plant and animal life of the waters, which is doubtless their more usual food resource. Would the destruction of the forests here seriously diminish the number of *Diaptomi*, and thus lessen the food supply of the young of the trout with which this lake has lately been stocked?

The large leeches taken here occur throughout the Park in suitable situations, and have been noticed by earlier collectors at Yellowstone Lake. At the Shoshone station they were frequently seen in the clear shallow water, either swimming actively or creeping along the bottom. They are carnivorous leeches, as already mentioned, almost the only native enemies of the *Gammarus* worthy of notice in Shoshone Lake.

A frequent and interesting occurrence during our visit was the appearance at the sunny surface of the lake of a large dark-gray caddis fly (*Neuronia* sp.) freshly escaped from its pupal prison and flitting rapidly along with its imperfectly expanded wings, just on top of the water, going with speed directly for the shore. The number of these insects—caseworms in the larval state—was shown by the thousands of their empty cylindrical cases washed ashore. Larvæ, pupæ, and imagos were all common at the time of our stay. The case of this species is composed of thin, irregular pieces of vegetation (largely fragments of leaves and epidermis of water plants), or of chitinous plates of insects, eked out by filamentous algæ and other miscellaneous objects, all cemented and imbedded in the tough secretion from the salivary glands of the insect itself. On preparing to pupate, the larva closes the mouth of its tube by a coarse latticework of hardened mucus which protects the insect within, permitting at the same time the free access of water. Shoshone Lake, it need not be said, was an ideal place for the breeding of these caddis flies, since it contained no common carnivorous animal large enough to attack them.

Chironomus larvæ were common in these waters, and their pupæ, ready to emerge, appeared often in the surface net.

The mollusks taken were limited to a few specimens of a large, dark *Physa*, with an exceedingly thin and brittle shell, and a small, heavy *Pisidium*, with a few conspicuous lines of growth. These last were mostly empty shells, collected from the hollows of rippled sandy bottom, where they were readily seen as one floated over in a boat. An occasional dragon-fly larva (*Libellulidæ*), large larvæ of *Hydrophilus*, a very few hydrachnids, some slender annelids—undetermined as yet, and very difficult of preservation—and a considerable collection of digitate fragments of *Spongilla* are worthy of mention. So also is the scarcity of waterbugs, limited, indeed, in our collections from the open lake, to a single specimen each of *Notonecta* and *Corisa*.

The small brown lagoon or pond already mentioned as occurring near the lake was an example of a kind quite common along the lake borders of this region. It is separated from the lake itself only by a narrow strip of beach, and is largely filled with pond lilies (*Nuphar*), grass, algæ, and the like, which grow out of a deep, soft ooze. There was little in the assemblage of animal forms of this place to suggest its elevation of more than 7,000 feet, unless the scarcity of mollusks and the higher *Crustacea* be so explained. A species of *Physa* and one of *Pisidium* were the only mollusks taken. Insects were represented chiefly by ephemerid larvæ, larvæ of *Culex*, *Chironomus*, and other small *Diptera*, caseworms, *Notonecta*, *Corisa*, *Agrion* larvæ, and larvæ of *Dytiscidæ*; *Hydrachnidæ* by a single species of scarlet water-spider; *Amphipoda* by the lake species *Gammarus robustus* and *Allorchestes dentata*; entomostraca most abundantly by a *Daphnia* of pale pink color, not seen by us before, and here described as *D. angulifera*, by *D. pulex* in moderate numbers, by *Polyphemus*, *Scapholeberis mucronatus*, *Eurycercus lamellatus*, *Chydorus*, *Cypris*, *Cyclops gyrinus*, *C. serrulatus*, etc., and by no *Diaptomi*, so far as observed. Leeches were present, although not numerous—the species already mentioned (*Nephelis maculata*) and one not detected in the lake, *Aulostoma lacustris* Leidy. This pond thus differed from the lake in the larger number and variety of insects, especially in the larval state, by the absence of *Diaptomi*, and by the vast predominance of the new *Daphnia*. The latter had evidently been very much more abundant earlier in the season, as shown by the quantities of its summer eggs. These formed a film over many square feet of the surface and had been washed ashore in quantity as a scum-like deposit along the bank. A few of the females were still bearing their ephippia.

The collections made by Prof. Linton from the lagoon at the western end of the lake are similar, as far as they go, but contain no entomostraca.

Lewis Lake.—Lewis Lake is so closely associated with Shoshone that the two might very well be treated by the biologist as one. The water, shores, bottom, and surrounding country have substantially the same characters for both, and their free connection by a river without falls and only some 3 miles in length tends to obliterate any small local differences. The fact that fishes are excluded from both lakes by falls in their common outlet still further assimilates them in biological condition, the only noticeable differences remaining being those of size and depth.

Lewis Lake is but 3 miles long by 2½ in breadth, with a greatest depth, in our soundings, of 80 feet. It is rudely triangular in form—more distinctly heart-shaped, in fact, than Heart Lake itself. Its level, 7,720 feet, is but 20 feet below that of Shoshone Lake. Its western banks are highest and boldest, the 8,000-foot contour running usually from a quarter to half a mile from the shore. On the north and northeast the country is relatively low toward Shoshone and Yellowstone lakes, but the immediate banks are occasionally bluffy and the shores are everywhere wooded. The Red Mountains are close at hand, a range of ten peaks to the southeast; and to the south looms the great Teton group, the noblest mountain view to be had from any part of the Park.

There is a small hot-spring basin at the northwest angle of Lewis Lake, and a swampy tract about half a mile square lies beside it to the northwest, connected with it for a fortnight or so during high water. At other times communication is prevented by a narrow strip of beach, sand and gravel, a few feet across. At a little trouble and expense a permanent passage-way for fishes might be made and maintained, giving free access to considerable breeding-grounds and stores of food.

On the west side a small permanent creek came in, about 30 feet wide and 2 feet deep at the time of our visit, with several acres of somewhat swampy ground at its mouth; and here also were three small warm creeks (150° F.) and one of cold water (50°), the latter apparently supplied by melting snow from the borders of the Pitchstone Plateau. A series of small lagoons, filled with sedge and bulrush, open into the lake along this shore. The cold waters from the Red Mountain range are diverted from this lake by the course of Aster Creek, which drains the northern slope and empties into Lewis River, about 2 miles below the lake.

Treacherous and stormy weather during our brief stay prevented our making many collections in the open water. The dredge was hauled, in fact, but once, and then at a depth of 56 feet, about a quarter of a mile above the outlet; and even the surface net was only twice used far enough from shore to give us the so-called pelagic entomostraca. The remaining collections were gathered inshore, in the swamp adjoining, and from streams, both warm and cool, on the western side.

In the dredge, at 56 feet, with a bottom of fine black mud and dead vegetable débris, we took quantities of the large *Gammarus*, a few *Allorchestes*, many *Chironomus* larvæ, specimens of *Pisidium*, and an undetermined annelid not preserved in condition for identification. The preponderance of *Gammarus* was as noticeable here as in the companion lake, although fewer were seen along shore in shallow water. The same may be said concerning the *Diaptomi* taken in open water in the surface net. The gigantic *Diaptomus shoshone* was relatively much less numerous, however, than the much smaller *D. sicilis* var. It was feeding extensively upon pine pollen here, as in the other lake. Although properly pelagic forms—those most at home, that is, in the open water and in the deeper parts of the lake and found rarely, if at all, in the small lagoons—these *Diaptomi* nevertheless extend their range close inshore, where they might be seen with the naked eye in the water or taken in the net, even when the surface was decidedly rough. These collections contained many examples of a peculiar entomostracan (*Holopedium gibberum*) not noticed in Shoshone Lake, and also an abundance of a colonial rotifer belonging to the genus *Conochilus*—allied to *C. volvox*, but apparently undescribed.*

In the lake, near the entrance of the warm stream on the western side, were quantities of young water-bugs (*Notonecta*), an occasional *Corisa*, *Gammarus*, *Chironomus*, and ephemerid larvæ. Caseworms were also abundant in the lake, and the air alongshore was full of two species, one black and the other pale brown, just emerged and pairing.

From a small lagoon filled with the overflow waters of a geyser, at the western side, we took with the hand net several specimens of *Gammarus* and hydrophilid larvæ, a few *Allorchestes dentata* and young *Corisa*, many libellulid larvæ, large and small, and larvæ of *Agrioninæ*, a single small *Physa*, and several water-beetles (*Cœlambus*).

From a warm stream at the same place (150° F.) we have many ephemerid larvæ, several caseworms and a single hydrachnid, a great quantity of large and vigorous specimens of *Gammarus robustus*, and a smaller number of *Allorchestes dentata*, many examples of *Pisidium*, a *Physa*, a few annelids (*Oligochæta*), and a single leech (*Nephelis 4-striata*) not taken by us before. The *Gammarus* was feeding very freely on dead and decaying vegetation and filamentous algæ, with some fresh vegetable fragments and a little pine pollen. No traces of animal food occurred in two specimens dissected, one half-grown and the other of the largest size.

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* Described on page 256 as *C. leptopus*, n. s.

From the swampy tract on the eastern side of the lake already mentioned collections were made by hauling a surface net in the open water, by searching dead leaves, and by washing off the lily pads (*Nuphar*) in the net. These waters were swarming with life, chiefly insect larvæ and crustaceans. They apparently contained relatively few mollusks, several specimens of a large *Physa*, a few *Pisidium* and one *Amnicola* occurring in our collections. The insect larvæ included *Agrion*, *Ephemera*, *Chironomus*, *Corisa*, *Hydrophilus*, and *Corethra*. The only amphipod crustacean was *Allorchestes dentata*, represented by but few examples, but the open water contained a great quantity of *Daphnia angulifera* and an occasional *Sida crystallina*. Among the lily pads the same *Daphnia* occurred, together with a great number of *Sida*, a few examples of *Cyclops* and *Diaptomi*, and several of *Daphnella* and of *Polyphemus pediculus* (young and adult), and a single short, dark cyprid. Leeches and their capsules were frequent, the usual spotted and striate species (*Nephelis maculata* and *N. 4-striata*). A single specimen of *Clepsine elegans* and another *Clepsine* not determined were also noticed. The capsules of these leeches were common on the leaves of water-plants. Among less conspicuous objects, small *Hydrachnidæ*, *Hydra fusca*, and the colonial rotifer *Conochilus* were abundant.

If we may pause now to glance at the animal life of these three lakes, characteristic as they are for their region, as compared with that of similar lakes of much lower altitude—Lake Geneva, in Wisconsin, for example—we find that the large and conspicuous differences, so far as invertebrates are concerned, lie mostly in mollusks and crustaceans. The complete absence of *Unionidæ*, of *Paludinidæ*, *Melaniidæ*, and of *Valvata*, and the scarcity of *Planorbis* and *Amnicola* are cases in point. The absence of crayfishes, of *Epischura*, and of *Simocephalus* is the most notable distinction in the crustacean list. *Polyzoa* also were extremely few.

Heart Lake.—Heart Lake had to us the very especial interest that it gave an opportunity, hitherto unparalleled in this country, to study by comparison the effect of the presence of fishes on the bionomic system of a mountain lake; and as the barren waters of Lewis and Shoshone lakes have since been stocked with trout by the U. S. Fish Commission, the results of this comparison of native conditions may hereafter be checked and supplemented by a study of the later state of invertebrate life in these two lakes. This lake is situated similarly to Lewis and Shoshone, is of nearly the same size as Lewis Lake, and is in most respects a companion to that and Shoshone, but differs totally in the fact that its outlet is unobstructed by falls and that it is consequently well supplied with fishes. It lies only 5½ miles from Lewis Lake, in a straight line, and about 6 miles from the southern arm of Yellowstone Lake, but the latter is on the opposite side of the divide and is consequently connected with a different system of waters. It is divided by a peninsula into two unequal parts, the larger of which, rudely rhomboidal in shape, is approximately 1½ by 2 miles in diameter. The smaller part is subtriangular, with principal diameters of about a mile, and the narrow neck uniting these two divisions of the lake is about a quarter of a mile across.

Heart Lake differs from Lewis and Shoshone by its closer proximity to the Red Mountains, especially to Mount Sheridan, and consequently by the much greater amount of snow water which it receives. At the time of our visit, during the last days of July, the rush of rivulets down the mountain slope, supplied by the melting snows, filled the air all day with a noise like that of a train of cars. This lake has also its hot-spring and geyser basin, but receives through Witch Creek a relatively larger body of warm water than either of the others. It drains, according to the published map of the Geological Survey, a larger basin in proportion to its size and is bordered on the north by a marshy tract 2½ miles long by nearly a mile wide. Its surface lies 250 feet below that of Lewis Lake and 270 below the Yellowstone. Its waters are very clear, but are nevertheless much more weedy alongshore than those of either of the other lakes.

The slope of Mount Sheridan continues downwards into the lake a little distance, and the water consequently deepens rapidly from the eastern shore. About 200 feet out the depth was 94 feet; at 400 feet it was 124; and at 1,000 feet it was 146. The bottom temperature at this latter depth was 40° F.

Our camp was pitched on the western side, about half a mile from the mouth of Witch Creek, and our work was confined to this shore and to a distance of about half a mile along the northern shore. Our dredgings here were made in three localities: in shallow water inshore, at a depth of about 10 feet; upon rocks a little distance out, at a depth of 30 feet; and in deep water from 46 to 120 feet, with a bottom of soft mud. Collections were made with the surface net from the open water at various hours of the day from 9 a. m. to 9 p. m., under such conditions of weather as offered themselves, and also from shallow water among weeds, commonly near the bottom. In addition to these, considerable collections of fishes were made with the trammel net and the smaller seines, the latter of which we used in Witch Creek as well as alongshore in the lake itself, and from these fishes a quantity of material was obtained for a study of the food of the various kinds.

As might be supposed, some noticeable differences appear on a comparison of our collection lists, some readily accounted for and others at present inexplicable unless as the secondary or more remote effects of the first. It is naturally to be expected that in so small a lake, and one with so few opportunities for successful concealment or escape, the kinds of invertebrates on which fishes feed by preference would be unable to maintain themselves in as large numbers as in similar situations where fishes do not occur at all; and especially will this necessarily be true if we find that the fishes destroying these invertebrates are not strictly dependent on them for food, but eat other things as well. This is true of both the trout and the sucker, the former being almost indiscriminately carnivorous, and the latter mixing insect larvæ and the like with a large proportion of vegetable food.

It is probably in this way that we are to explain the fact that we did not find in our stay on this lake a single larva of *Neuronia* (the largest caseworm in these waters), so abundant in Shoshone Lake, nor a single amphipod crustacean (*Gammarus* or *Allorchestes*)—all large enough to afford an attractive food to one or all of the fishes in these waters. That they occur here I can scarcely doubt, although the distribution of the *Gammarus* seems at best very whimsical in this region, but they certainly were far less common than in the adjacent lakes. The absence of the larger leeches (*Nephelis maculatus*) may be due to our failure to find suitable places for them, or they also may be eaten by fishes.

More difficult to understand is the very remarkable fact that we did not find here so much as a single specimen of the almost gigantic copepod, *Diaptomus shoshone*, although its companion elsewhere, the smaller species of *Diaptomus*, was extremely abundant in all our open-water hauls. Equally difficult of explanation was the vast abundance of the entomostracan *Daphnella brach*[illegible]e taken before we reached this lake, and here the most abundant species next to *Diaptomus*. With it was *Leptodora hyalina*, also extraordinarily common (for a predaceous species) in the product of every haul. The absence of *Polyphemus pediculus* is less remarkable, since it was not common in the other lakes, and the fact that *Holopedium gibberum* should be wanting here while common in Lewis Lake is without special meaning, since we failed to find it in Shoshone Lake.

A fuller discussion of this matter must be postponed until our materials illustrating the food of fishes taken here have been completely studied; and I will merely add at present some further details concerning the general collections.

The beach on the west shore was gravelly, in some places with boulders of considerable size, and occasionally with a stretch of sand. The bottom was covered with a growth of weeds (*Potamogeton*, algæ, etc.) and was greatly cumbered with driftwood. Our deepest dredging was made off this shore, beginning at a depth of 120 feet, with a temperature of 40° F., and ending at 46 feet, with a temperature of 53°. This haul, made from a raft and boat together, was about 100 yards in length, over soft mud containing some very fine sand, but consisting largely of organic débris, both vegetable and animal. The latter, minutely examined, was seen to be made up of the valves of entomostraca, fragments of the cuticle of insect larvæ, and the shells of rhizopods (*Difflugia* and *Echinopyxis*), while the vegetable remains consisted of minute pieces of *Vaucheria* and other filamentous algæ, and fragments of higher plants, with a multitude of shells of diatoms. The living animals of this haul were *Chironomus* larvæ and pupæ only, the former red, and many of them in their usual tubes composed of mud and minute organic remains.

The shallower hauls, made at a depth of 30 feet on a bottom of rock and gravel covered largely with *Cladophora*, aggregated about 50 yards in length. A quantity of material was brought up and all critically examined. It was composed almost wholly of red *Chironomus* larvæ and their tubes, together with a few specimens of *Pisidium*. A single ephemerid larva (*Cœnis*) was the only other animal found. On the various alongshore hauls, at or near the bottom and through the weeds, the following forms were obtained: Larvæ of *Chironomus*, ephemerid larvæ, caseworms (a single specimen seen), small hydrachnids, *Physa* and *Pisidium* (only a few of each), *Cyclops gyrinus* and other species, *Diaptomus sicilis* var., *Daphnella brachyura*, *Daphnia arcuata*, *Eurycercus lamellatus*, *Acroperus leucocephalus*, *Leptodora hyalina*, *Bosmina longirostris* and some undetermined cyprids, *Stylaria lacustris* and other annelids, and an abundance of *Hydra fusca* of the brick-red variety. The most abundant thing was *Daphnella brachyura*, and the next *Diaptomus*. The *Cyclops* was common, as were likewise ephemerid larvæ and the small bivalve entomostracans *Eurycercus* and *Acroperus*.

The towing-net collections, made in the open water some little distance from the shore, contained a much smaller variety, all entomostraca and hydrachnids. The latter were few in number, noticed only in a single haul. By far the most abundant species were *Diaptomus sicilis* (?) and *Daphnella brachyura*, sometimes one predominating and sometimes the other. With these were *Leptodora* and an occasional *Daphnia*.

The abundance of fishes in the lake was shown by the fact that our trammel net, simply stretched in the open water in the evening and lifted at noon the following day, contained 87 fishes, 12 of them trout, the remainder suckers and chubs, the latter most numerous. At another setting of this net, near the mouth of Witch Creek, in 8 to 10 feet of water, 10 trout, 2 chubs, and 65 suckers were taken in six hours.

YELLOWSTONE RIVER SYSTEM.

Yellowstone River drains all the eastern and northern side of the National Park, more than half its area, and from these waters much the larger part of our collections was taken. Yellowstone Lake was visited both years; Pelican Creek and smaller tributaries at the northern end were searched; and Yellowstone River was examined at intervals from the lake to the mouth of the Lamar or "east fork." The smaller tributaries of this system examined were Alum Creek, Tower Creek, Slough Creek, Lamar River, Amethyst Creek, Soda Butte Creek, Blacktail Deer Creek, Lava Creek, Glen Creek, and Gardiner River. Collections were also made from numerous lakes and ponds connected with this drainage system: Duck Lake near the west bay of Yellowstone Lake; some alkaline ponds near Baronette's Bridge across the Yellowstone; Fish Lake, near the Soda Butte; Twin Lakes, on the flat dividing the head waters of the Gibbon from those of the Gardiner and drained by Obsidian Creek; Lake of the Woods; Swan Lake, draining into Glen Creek; a small lakelet near Mammoth Hot Springs, connected with the Gardiner; and Boteler Springs, outside the Park.

Yellowstone Lake.—With Yellowstone Lake we reach the aquatic headquarters of this region, the real center of interest and importance for the study of the invertebrate life of Yellowstone Park. It is the largest lake so near the summit of the Rocky Mountains, and, excepting its high altitude, presents every feature suitable to the maintenance of an abundance of animal life. Its zoölogical interest is fittingly supported by its geographic and scenic features, which supply an admirable setting to the picture of life that slowly shapes itself in the mind of the zoölogist as he studies its waters and their contents and the inhabitants of its bottom and shores in their relation to each other and to surrounding nature.

The geology of the region shows that the present lake is only the relatively small remnant of a much larger body of water which formerly filled Hayden Valley and extended down the Yellowstone nearly to the present falls; but there is, I think, no reason to believe that it has dwindled in zoölogical importance as it has in size. Except for changes of climate, the variety of animal forms a lake of this size may maintain need not be surpassed (and commonly is not) by that to be found in one many times its size. It is not likely that there was ever here, when this lake was largest and deepest, a special interior and deep water fauna, such as occurs, for example, in the Great Lakes of North America; for, if there were, remnants of it would certainly continue and would have appeared in our deep-water dredgings. As a home of animal life it has probably been for ages similar to what it is now, except that we must suppose that the single species of fish which now inhabits it—evidently an immigrant across the continental divide—has produced certain changes in the balance of life, some of which will doubtless become more apparent as our collections from this lake are thoroughly studied.

The most striking feature of Yellowstone Lake is the irregularity of its form and the consequent length of its shore line, such that with an area of about 140 square miles, its shore line approaches 100 miles in length; a fact whose biological significance will be understood if we call to mind that the greater part of the food of fishes in such a lake is to be found among the weeds of its shoal waters alongshore. From a main body (a fairly regular parallelogram, 7 by 12 miles) several large arms or bays project to the west and south, giving the whole lake an extreme length of 20 miles and a width of 14. The immediate banks are generally abrupt, although not high, with a narrow gravel beach, and except along the tributary streams there is little or no swampy ground about the shore. The Yellowstone above the lake, however, runs, as do most streams in this region, through a wide, swampy bottom, which must afford an immense field for the breeding of fishes and for the growth of their food; and Pelican Creek, the next largest tributary, is similarly situated, while several of the smaller creeks have each at their mouth a little bar, piled up by waves and ice, which has partly stopped the outlet and so formed above it a weedy lagoon or marshy bay.

The bottom commonly slopes gradually downward, making an abrupt descent, so far as known, only from the shores of Frank Island and from the lofty summits about Southeast Bay. Beyond the beach of gravel and boulders which commonly borders the lake, comes usually a belt of sand or sandy gravel, and beyond this a sandy mud, becoming finer and darker inwards, until in the deepest water reached it was a very fine black ooze. The greatest depth reported by the Hayden survey was 300 feet, in the center of West Bay. My own deepest soundings were incidental to our dredging operations, and were limited to a distance of 2,000 feet from shore off our camp at Hot Spring Basin on West Bay, and to an area north and east of Stevenson Island, where the lead was dropped at distances varying from half a mile to 2 miles from the island. The greatest depth reached in this area was 231 feet, at a point nearly equidistant from Stevenson Island and Steamboat Point.

My only temperature observations were made August 4, 1890, at which time the surface temperature of the water was 62° F., the bottom at 100 feet was 46°, and at 184 feet, 42½°.

This lake lies almost at the summit of the Rocky Mountain watershed, the continental divide following approximately the outline of its western and southern borders for about 40 miles, at distances varying from a mile to 5 miles from the shore. To the westward of the lake lie broken pine-covered hills, which rise from 250 to 800 feet above its level. To the north are the dark ridge of the Elephant's Back, about 850 feet above the lake, and the Sulphur Hills, which finally rise to a height of 9,000 feet above the sea. On the east lies a mass of rugged volcanic mountains, a part of the Absaroka Range, patched with snow all summer. They approach the shore most closely along the southeast arm at the upper end, where the scenery is very bold and fine. A few peaks rise to a height of 11,000 feet above the sea at a distance of 5 or 6 miles from the shore. The boldest elevations are those just below the mouth of the inlet, where mountains less than 2 miles away reach a height of 9,600 feet.

Besides the Upper Yellowstone and Pelican Creek, already mentioned, the principal tributaries to the lake are a number of small streams which drain these eastern mountains, and, taking their waters from the melting snows and flowing most of their way through overhanging forests, bring to the lake a considerable amount of very cold water. The hot springs and geysers are found mostly on the western arm and at Steamboat Point in the northeastern part of the lake, but the amount of warm water contributed by them is quite insignificant for so large a lake.

In the open water there was always a very fair supply of entomostraca, both *Cladocera* and *Diaptomi*, but at the time of our arrival on the West Bay the phenomenal fact was the vast abundance, both in deep and shallow water, of a rotifer or wheel animalcule which forms rolling spherical colonies imbedded in a gelatinous medium, each colony consisting of a little cluster of these animalcules arranged in such a manner that their inner ends approach each other in the middle of the mass, while their outer ends, with mouths, cilia, etc., are exposed on the surface. To the naked eye these colonies of rotifers appear like minute grayish specks of floating matter. This species belongs to the genus *Conochilus*, but differs noticeably from the common *C. volvox*. I have thought best, consequently, to describe it as *C. leptopus* (page 256). It was so abundant in the water that a haul of a ring net, a foot across, for fifty strokes of a single pair of oars gave a measured half pint of this form alone.

This colonial rotifer is not to be confounded with the "water bloom," which developed in Yellowstone Lake a little later to an extent very embarrassing to our surface net work. This so-called "bloom" consisted of specks of various algæ growing so freely in the water as to give it a faint tint of dirty green, and washing ashore in quantity along the leeward side of the lake, usually at this season the northern and eastern.

Away from the shore, by far the most common crustacean was *Daphnia pulex.*[*] Although in ordinary situations the males of *Daphnia* are by no means common, in our Yellowstone Lake collections, made in August and September, the males of this variety were many times commoner than the females, making sometimes nearly the whole of a large catch. The few examples of the other sex seen were mostly young, although a female bearing the ephippium occurred occasionally. Next in abundance was the smaller of the *Diaptomi* found in Shoshone Lake, the so-called variety of *D. sicilis*, and with this came somewhat rarely, but still fairly abundant, *D. shoshone* and *D. lintoni*. Several species of *Cyclops* occurred here, only a new one (*C. minnilus*) very frequently, however, and this in small proportion.

Most of these crustaceans ranged in shore as well as in the deeper water of the interior parts of the lake, *Daphnia pulex* falling away in numbers more rapidly in shallow-water collections than *Diaptomus sicilis*. To these inshore species we may add, from our surface-net collections, *Polyphemus pediculus* (sometimes very abundant among the weeds), *Cyclops gyrinus*, and *C. serrulatus* (both rare), *Chydorus sphæricus* (few), *Scapholeberis mucronatus* (few), *Cypris* sp. (only occasional), *Alona*, and the usual miscellaneous drift of shore forms, *Chironomus*, *Allorchestes* (both *dentatus* and *inermis*), *Gammarus*, caseworms, hydrachnids, planarians, *Clepsine*, etc.

Collections made in the lake near enough to the outflow of hot springs to exhibit their influence differed from those made in cold water only in their more scanty character; and where the water was actually warm it commonly contained nothing but the larger crustaceans, insect larvæ (especially caseworms), and other alongshore material, together with the dead and empty débris of insect transformation. It was in fact very clear that the frequently observed basking of small fishes in these warm waters was not caused by a greater abundance of their food.

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[*] The common and even abundant occurrence of this species in Yellowstone Lake as a form apparently pelagic in its habits (widely contrasted, consequently, with its usual character) was so unexpected and unusual that I hesitated long before assigning this *Daphnia* to the species most abundant in our stagnant pools. Prolonged study of it from various collections in the Park in comparison with those from the waters of Illinois, has finally led me to conclude, however, that this Yellowstone Lake form is not to be specifically distinguished from American examples of *pulex*. In order to furnish material for a more critical comparison than has hitherto been made of the American and European representatives of this species, I append a description, under the varietal name of *pulicaria*, based upon Yellowstone specimens, with figures of both sexes (page 242 and plate XXXVII, fig. 1).

A comparison of the collections made at and beneath the surface, by day and by night, in sunshiny and in cloudy weather, would seem to indicate that the lake variety of *Daphnia pulex* is much more sensitive to sunlight than any other associated form. In collections made at the surface after dark, and in those made in sunny weather below the surface, this was many times the most abundant crustacean; but in similar collections made at the surface in sunshine it was relatively rare, *Diaptomus sicilis* then taking the lead.

Only brief time and scanty opportunity could be had for miscellaneous alongshore work during our visits to Yellowstone Lake. The greater importance, from our point of view, of deep-water work, the stormy weather, and the unfavorable character of the beaches, commonly either covered with bare gravel or packed with large boulders and beaten by surf, made such work unprofitable and difficult. Nearly all our knowledge of this alongshore fauna we owe, in fact, to a day spent in 1891 on Stevenson Island (1¼ miles long by ¼ mile wide), lying 2 miles from the hotel landing, in the north end of the lake. The shores of this island vary from precipitous bluffs on the west to a weedy shallow on the south. The beach is gravelly everywhere, except as boulders thickly cover the bottom and banks, and outside this is a belt of gravelly sand, followed by sandy mud still farther out. Water weeds occur in scanty patches, chiefly *Chara* and algæ; a coating of minute, dirty algæ commonly covers the stones. On the stones are also countless tubes of small *Chironomus* larvæ, almost covering the surface, mostly emptied by the maturing of these insects at the time of our visit. Under the stones are a considerable number of leeches of various sorts (mostly *Nephelis* and *Clepsine*), and an occasional small annelid worm. On them, among the weeds, a small, black, spiral mollusk, *Physa*, may occur by hundreds, and creeping under or over them, or swimming through the water just above the bottom, we found an occasional *Gammarus*. A large species of *Corisa*, several water-beetles (*Deronectes*), and a perlid larva were all the other insect forms taken here. A small collection of entomostraca from the weeds has not been determined.

Our knowledge of the bottom fauna of Yellowstone Lake is based on the product of eleven dredgings, at depths varying from 15 to 198 feet. Four of these dredgings were in shallow water, 20 feet or less; two were from a medium depth (25 to 50 feet); one ranged from shallow water to deep (20 to 120 feet); one from a medium to a considerable depth (40 to 100 feet); and three may be classed as deep throughout, ranging from 186 to 198 feet. In this deepest water the most abundant inhabitants of the bottom were long and slender annelid worms (*Oligochœta*) not yet studied, blood-red larvæ of *Chironomus* of considerable size, and a small bivalve mollusk (*Pisidium*). Several leeches also occurred in our deepest hauls (*Nephelis maculata* and species of *Clepsine*), a few specimens of *Gammarus*, probably taken after the dredge left the bottom, several small planarians, a lot of living *Spongilla*, and in one instance a *Physa* on living vegetation—in all probability a floating fragment, as the haul on the bottom here was made at not less than 186 feet. In other dredgings, at 100 feet or more, many specimens of *Cypris*, a very few hydrachnids (probably swimming above the bottom), and several worms (nematoids) were added to the above list.

As we worked into shallower water the *Gammari* and the leeches became more abundant, especially *Clepsine*, and at 25 to 50 feet univalve mollusks (*Planorbis exacutus* and *Physa*), *Allorchestes inermis*, small white *Chironomi*, larvæ and pupæ, and caseworms in sand tubes appeared. At 15 and 20 feet, among the weeds, the assemblage of associated animals was *Daphnia*, *Diaptomus*, *Conochilus*, all abundant, many oligochæte worms, leeches and leech capsules, *Physæ*, *Limnææ*, *Allorchestes*, *Gammari*, and cyprids (*Cypris barbatus*, n. sp.), various caseworms, nymphs of *Ephemeridæ*, *Chironomus* larvæ, and larvæ of *Tabanidæ* and *Culicidæ*.

No discussion of the zoölogical resources and relations of Yellowstone Lake with reference to fish-culture would be even approximately complete which did not take account of the animal contents of the streams and other waters connected with it, since these are the principal resorts of the young of the only species of fish the lake now contains and must always be the chief breeding-places of fishes generally. Apart from the river above and below the lake, the most important tributary is Pelican Creek, a peculiar stream for a mountain region in the fact that for 2 or 3 miles of its lower course it is broad, muddy, and comparatively sluggish, more like a bayou than a creek, thick with vegetation, and much frequented by water birds, whose feathers floating on its semi-stagnant surface gave it the appearance of a barnyard pond. Above this stretch, although still bordered by willow-covered and more or less marshy bottoms, it becomes swift and rocky, except where cut across by numerous beaver dams.

The sluggish waters just above its mouth are, as might be expected, rich with small crustaceans and insect larvæ. Amphipod crustaceans were very scarce in this creek, *Gammarus* not occurring in our collections, and *Allorchestes* but once; and among entomostraca, gigantic specimens of *Eurycercus lamellatus* were far the most numerous, making three-fourths of the entire bulk of the product of hauls made in open water and among algæ and other water weeds. With these, in open water, were a new species of *Macrothrix*, a *Diaptomus*, an occasional *Daphnia pulex*, several specimens of *Cyclops*, a few of *Daphnella* and of *Cypris*, and a single *Allorchestes*. Among the algæ, besides the foregoing, several examples of *Simocephalus vetulus* were taken, together with *Bosmina*, *Ceriodaphnia*, *Polyphemus*, and *Chydorus sphæricus*. The most abundant insects were, of course, *Chironomi*—larvæ, pupæ, and adults just emerging—and ephemerid larvæ. A few *Corisæ* and caseworms, some small aquatic *Coleoptera*, and a single living *Limnæa* were also noticed.

In the shallower and swifter parts of the stream insect larvæ take the lead, the bulk of the collections consisting of large and small caseworms of various species, most of them attached to stones, larvæ of *Chironomus*, ephemerid and perlid larvæ, large *Corisæ*, and several beetles of small size. The caseworms and ephemerid larvæ were exceptionally common.

On the whole, this stream—which must stand for the present as an example of many others—contained invertebrate forms of animal life in very fair abundance; in the swifter waters the insect larvæ (neuropterous and dipterous) which lurk under stones, and in the more quiet parts entomostraca and insect larvæ of different habit.

A much smaller creek, known on the map as Bridge Creek, and noted among tourists because crossed by a perfect and highly picturesque "natural bridge," has at its mouth a small pond or lagoon which was searched with some care during half a day. This pond is shallow and muddy, but mostly clear in the middle, with a fringe of aquatic vegetation and stout marsh grass growing in the water. The clear water was full of minute spherical masses of algæ, among which were a *Diaptomus* and *Polyphemus*—apparently the usual lake species, but not preserved. In the grass were great numbers of *Gammarus robustus* and a few *Allorchestes inermis*, and ephemerid larvæ were abundant everywhere. *Chironomus* larvæ were common in the collection and doubtless very abundant in the mud, and a robust *Corethra* larva was occasionally taken. Small water-beetles (*Deronectes* and *Haliplus*), caseworms with cases made of fragments of vegetation and others of fine gravel, *Corisa*, a water-skater (*Hygrotrechus*), black *Poduridæ*, and occasional terrestrial insects were among the other insect elements available for the food of fishes. The mollusks of this little collection were small *Limnææ*, *Physæ* (large and small), *Pisidium*, and *Valvata*. Various leeches (the most abundant the common *Nephelis maculata*), *Hydrachnidæ*, and planarians complete the list thus far made up.

The pond was swarming with young mountain trout (*Salmo mykiss*), a few of which I dissected for a determination of their food. One of these an inch and a half in length had eaten *Chironomus* larvæ and imagos chiefly, the remainder of its latest meal consisting of other insect larvæ not in condition to identify, and the entomostracan *Polyphemus pediculus*. A second, an inch and a quarter long, had also fed mostly on *Chironomus* in its various stages of larva, pupa, and imago, but had made about a third of its meal from entomostraca (*Daphnia pulex* and *Polyphemus pediculus*). Another, still smaller (0.92 of an inch long), taken from the open lake, among the small weeds growing on a flat, muddy rock, had filled itself with *Chironomus* pupæ only, as had still another of the same size. A third specimen from this situation had eaten more larvæ of *Simulium* than of *Chironomus*, and a fourth had also eaten *Simulium* larvæ and another dipterous larva unknown to me.

I may add here that other young trout, in a small, swift rivulet near the Lake Hotel, were feeding continuously, August 9, on floating winged insects, mostly, if not all, *Chironomus* and smaller gnat-like forms.

The large leeches at Bridge Bay (*Nephelis maculata*) betrayed their scavenger habits by collecting in numbers upon a dead fish, which they were evidently feeding from. Two specimens taken elsewhere in this pond proved on dissection to have the alimentary canal nearly empty, one containing only a few fragments of *Gammarus* in the rectum, and the other a single leg of a *Gammarus* in the œsophagus.

As illustrations of the smaller animal life of the river below the lake and in its vicinity, I may report the product of two trips made August 11 and 23, one from a quarter to half a mile below the outlet, and the other to a point about a mile below.

The most fruitful ground at the first locality was a sedgy flat on the left bank and a bed of flat rock covered with algæ and other fine vegetation, with about 6 to 8 inches of water. Other collections were made from the bare sandy bottom, in water 6 inches deep, with moderate current.

On the weedy rocks occurred the large hairy *Cypris* described herewith (p. 244) as *C. barbatus*, and other small blue cyprids not yet studied. The presence of *Chironomus* larvæ, several sorts of caseworms, larvæ of ephemerids, *Hygrotrechus*, *Corisa* (larva and adult), various water-beetles, specimens of *Gammarus robustus* and *Daphnia pulex*,

Physa (small and large, in quantity), *Pisidium*, many *Limnææ*, of various sizes, ***Planorbis***, and small *Amnicolæ*, accounted sufficiently for the fry of the mountain trout abundant among the weeds. The most interesting object here, however, was a small cylindrical brown turbellarian, which has the habit of swimming freely through the water, rolling over steadily from side to side as it swims. Although common here and easily taken, every effort at its preservation failed completely, the specimens going to pieces in spite of the varied use of hot water, corrosive sublimate, cold and hot, osmic acid, Perenyi's fluid, etc. This interesting form seems, notwithstanding, worthy of special mention, and I have drawn up the following brief description, made from field notes, which may serve to identify it to some collector more fortunate than I in his opportunity to study it closely.

Form cylindrical, tapering a little toward both ends, the posterior end blunt-pointed, the anterior flattened in creeping, and broadly rounded. Locomotor surface not specially flattened. When swimming the two ends are similar. Length, when extended, 5 to 9 millimeters, width 1 millimeter. To the naked eye dark reddish or orange, slightly paler before and beneath. Closely examined, the color is in minute, irregular flecks on a yellowish ground, and varies in intensity, of course, according to the extension of the worm. Sometimes the intestine shows through as a darker median shade, and the orange-brown eggs, 0.25 millimeter in diameter, also deepen the color locally. When emptied of these, its color is nearly uniform reddish-brown. The eggs are spherical, conspicuous, in two ovaries, one each side of the abdomen, and, to the number of twenty, may nearly fill the body. A pair of eye-spots placed at a distance from the front of the head about equal to the diameter of the body.

These worms were found in 1891 (September 1), much more abundant than at the above locality, in some clear, gravelly pools filled with filamentous algæ along Soda Butte Creek. They were everywhere thick among the algæ, and could be collected by scores in an hour.

At the lower locality mentioned above, several ephemerid larvæ, specimens of *Gammarus robustus* and of *Allorchestes inermis*, caseworms with cases made of fragments of bark, larvæ of *Simulium*, and some small planarians were found.

Finally I close this preliminary account of our Yellowstone Lake collections by noting the results of a brief examination of the contents of the warm waters along the shores of the hot-spring basin of West Bay.

Hauling August 3, 1890, in shallow water only a few feet from shore, at temperatures varying from 70° to 101° F., where the ordinary surface temperature was 62°, we took a great quantity of the rotifer *Conochilus leptopus*, very many examples of ***Polyphemus pediculus***, a few *Diaptomi*, and a very few specimens of ***Daphnia pulex***. There were probably five times as many examples of *Polyphemus* as of all other entomostraca. The *Diaptomi* were *D. shoshone* (a few) and several *D. sicilis*, and all the other entomostraca were a few each of *Cyclops serrulatus*, *Scapholeberis mucronatus*, and *Chydorus sphæricus*. There were no insects in these collections, living or dead, and the total amount of animal life was much below that of the cold water adjacent. In a spring near shore, with a temperature of 103° F., containing much ***Oscillaria*** and full of a dark-red alga, there were many holotrichous infusoria and other smaller ciliata, minute flagellata, a fine anguillulid, a small, active planarian, and many examples of a rotifer (***Monostyla***) allied to ***M. cornuta***, but apparently new. (See page 256.)

Duck Lake.—As additional material for comparison, the results of a visit to Duck Lake, close beside the West Bay of Yellowstone Lake, may be worthy of present mention. This clear, cold lakelet, about half a mile long and three-fourths as broad, lies in a steep, oval hollow of the woods, its shore without beach, too deep for vegetation, and surrounded by a tangle of fallen trees—a secluded woodland pool. The special peculiarity of the little collection brought in from here August 4 consists in the predominance of *Diaptomus lintoni* (the only *Diaptomus* found) over the other entomostraca, and the vast abundance of a shelled infusorian (*Difflugia globulosa*) brought up by the dredge at 65 feet and by the towing net sunk to a depth of about 30 feet.

Alongshore a small but miscellaneous collection was made of dragon-fly larvæ (*Libellulinæ* and *Agrioninæ*), larval May flies and *Chironomus*, of several *Amphipoda* (mostly *Allorchestes dentata*), of various entomostraca, among which were *Simocephalus vetulus*, *Cyclops gyrinus*, and other species of *Cyclops*, *Alona*, etc., and of the common large leech, *Nephelis maculata.* In the dredge, besides the *Difflugia* already mentioned, were several specimens of cyprids (*Candona*), very many *Chironomus* larvæ in their tubes, *Cyclops minnilus* (a few), a few *Corethra* larvæ, *Diaptomus lintoni*, and a small anguillulid worm. The water at some depth was loaded with small pellets of uniform size and similar shape, made up of diatoms, fragments of filamentous and other algæ (mostly emptied of chlorophyl), and of other vegetable débris together with grains of sand, all of which had the appearance of being the excrement of the common *Chironomus* larva. So thick was this material that it soon lined the surface net when hauled some 30 feet below the surface. With it came, besides *Difflugia*, a few each of *Corethra* larvæ, *Daphnia pulex*, *Diaptomus lintoni* (all females or young), and a single *Gammarus.* A surface haul gave a substantially similar product, with the addition of the entomostracan *Sida crystallina*, not recognized in the adjoining lake.

Lake of the Woods.—Here, as well as anyhere, may be reported the product of a very little work done with the dip net along the margins of a little oval pond a quarter of a mile in length, lying among the hills above Obsidian Cliff, at a height about the same as that of Yellowstone Lake. It has neither outlet nor inlet, and is doubtless fed by springs. It was evidently shallow, although it was not sounded by us, its bottom apparently fathomless mud, and the open water of its center bordered all round by a belt 100 feet wide of pond lilies and the usual accompanying vegetation.

Collections could only be made among the lily pads with a hand net from a log near shore. They were remarkable only for the variety of entomostracan and insect forms and the vast abundance of a *Stentor* which blackened the surface in patches some inches across and covered the lower surfaces of the lily pads as if with a layer of soot. This is allied to *Stentor igneus*, from which it differs, however, by characters to be derived from the description published on page 256. The principal insects taken were ephemerid and *Chironomus* larvæ, a few caseworms, a specimen of the water-beetle *Graphoderes fasciaticollis*, many black spring-tails (*Poduridæ*), and several water-spiders. *Sida crystallina* was the most abundant crustacean, but specimens were also taken of *Scapholeberis mucronatus*, *Cyclops*, *Diaptomus*, *Simocephalus vetulus*, and *Acroperus leucocephalus.* A few examples of *Allorchestes dentatus* were also seen. and a fragment of a hairy, bristled worm (*Naidomorpha*).

GARDINER RIVER SYSTEM.

Twin Lakes.—Collections were made August 20 from the upper of two small, closely connected lakes called the Twin Lakes, lying in the boggy trough between the hills beside the main road from Mammoth Hot Springs to the Norris Geyser Basin. This and the two following lakes belong to the Gardiner River system. The Twin Lakes give origin to a small stream known as Obsidian Creek, through which they are connected with a great expanse of swamp and shallow weedy water, known as Beaver Lake. The upper lake is a clear, clean-looking pool, with much marginal vegetation (lily pads and the like), and with boggy banks which drop off suddenly, forming an overhanging grassy margin. Several discolored springs open into the lake, discharging into it water which is said to contain alum in solution.

The dredge brought up from the deepest water found (beginning at 30 feet and ending at 39), a quantity of very soft, streaked, ill-smelling mud, with a little dead vegetation and a very small proportion of animal life. This consisted mostly of *Chironomus* larvæ, partly red, but most of them faded brown, as if discolored by their surroundings. The only other product of the dredge was two specimens of *Gammarus*, a single leech (*Clepsine*), and one *Pisidium*. The water itself, however, was well stocked with animal life, and a haul of a towing net above the bottom, at a depth of 30 feet, at 11 a. m., in bright sunshine, with a stiff breeze blowing, gave a considerable number of *Gammarus*, a very good collection of the characteristic entomostracan of this lake (*Diaptomus lintoni*), and several specimens of *Daphnia* and *Corethra* larvæ. A surface haul under the same conditions gave a few examples of *Daphnia schœdleri*, an occasional *Cyclops*, a single ephemerid larva, and a large quantity of *Diaptomus lintoni*. Alongshore, upon the weedy bottom—an admirable lurking and feeding ground for fish—were the commoner insects (*Notonecta*, *Hygrotrechus*, ephemerid and agrionine larvæ), several specimens of *Gammarus*, a great quantity of the entomostracan *Sida crystallina*, and a few *Simocephalus vetulus* and *Chydorus*. Curiously, not a caseworm was taken from this lake—a fact possibly to be explained by the peculiar character of its bottom. A careful search was made from the boat and along the bank for signs of a plant of mountain whitefish made here the preceding year by Mr. Lucas of the U. S. Fish Commission, but no trace of them was found.

Swan Lake.—This lake, a quarter of a mile long by two thirds as wide, is of nearly the same size as the two preceding, but is, perhaps, the shallowest of all (not over 3 feet in depth). It lies on a plateau of the same name, not far beyond Terrace Mountain and beside the main Hot Springs and Geyser Basin road. Its waters are derived from the adjacent mountains to the west, and pass out through Glen Creek into the Gardiner. As it lies in a plain, its immediate surroundings are level. Its bottom is of rock and sandy mud, with *Chara* and other weeds, and a strong growth of rushes inshore.

The collection lists from this little lakelet are unusually full, a fact apparently due chiefly to its geological surroundings. All the waters previously discussed are situated in the Park plateau, and the rocks of their drainage basins are all lava in some form, usually that modification of it known as rhyolite. Swan Lake, on the other hand, is in a cretaceous region, where the geological deposits are largely limestone. We found here, August 29, seemingly in consequence of this fact, an extraordinary abundance of mollusks; large *Limnæa* in the grass at the margin, a small *Planorbis*, *Pisidium*, *Sphærium*, etc. *Gammarus* occurred here under stones, and numbers of *Allorchestes dentatus* were taken in the weeds.

The insects collected were species of *Hydaticus* and *Hydroporus*, *Notonecta* and *Corisa*, caseworms, and *Chironomus* larvæ. A few water-spiders (hydrachnids) were taken among the weeds, and on the stones were great numbers of the cocoons of the large leech, *Nephelis maculata*. Young of this leech were numerous, and an occasional adult was seen, with specimens of *Clepsine ornata* and other species of the genus. The most abundant entomostraca were *Daphnia schœdleri* and *Diaptomus sicilis*, var., frequent specimens of *D. shoshone* occurring with the latter. That this large species, previously found only in the larger lakes, should replace here in this shallow pond the *Diaptomus lintoni* elsewhere characteristic of shallow water, was another of the surprises of distribution and association of which these mountain lakes are fruitful. The other small *Crustacea* noted were *Cyclops*, *Eurycercus*, *Alona*, and several species of *Cypris*. The occurrence of *Spongilla* here is also worthy of mention.

Gardiner Lakelet.—Similar to the foregoing in geological situation, but smaller, deeper, and surrounded by deep and broken hills, is a little pond formed in the course of a swift and rocky stream to the west of Gardiner River, between Mammoth Hot Springs and the town of Gardiner. It is about 250 yards long by three-fourths as wide, and 20 feet deep in the interior, with its marginal waters filled with a strong growth of rushes and other vegetation. It was full of entomostraca, gammarids, and insects. On the stones were great numbers of the egg capsules of the common large leech, *Nephelis maculata*, and many young of this species were crawling about, but the time for the adults had apparently gone by. The assemblage of entomostraca was again peculiar, the most abundant form being a *Ceriodaphnia*, and the next commonest a medium-sized *Diaptomus* (mostly immature), described on page 253 as a new species under the name of *D. piscinæ*. There were also many specimens of *Cyclops*, an occasional *Daphnia pulex*, and several of *Chydorus*, in a collection obtained by drawing the surface net through the open water. *Chironomus* larvæ were, of course, abundant; and worms of various kinds, small flat planarians, larvæ of *Agrion* and *Dytiscidæ*, species of *Haliplus*, *Corisa*, and *Notonecta*, larvæ of *Libellulæ* and ephemerids, species of *Clepsine* and of *Physa*, were represented in our collections.

Small ponds.—Occasional roadside collections made from small standing pools will be of interest chiefly because of the locality and altitude. The ordinary contents of such waters at the time of our visit may be learned from the following lists:

Weedy pool between Norris Basin and Grand Cañon, August 21, 1890:

Chironomus larvæ (a few).
Corethra larva (one).
Corisa larvæ (three).
Diaptomus lintoni (many).
Cyclops (a few).
Polyphemus pediculus (a few).
Daphnia pulex (many, with ephippia).
Daphnia schœdleri (a few).
Scapholeberis mucronatus (very many).
Ceriodaphnia reticulata (many).
Chydorus sphæricus (very many).
Macrothrix sp. (one).
Acroperus leucocephalus (one).

Weedy beaver pool near Soda Butte Creek, September 1, 1891:

- Agabus sp. (two).
- Hydroporus sp. (several).
- Colymbetes sp. (one).
- Dytiscidæ (larvæ).
- Corisa sp. (several).
- Ephemerid larvæ (a few).
- Chironomus larvæ (many).
- Phryganeidæ (many, with cylindrical tubes made of cylindrical pieces of vegetation).
- Turbellaria (brown cylindrical species. See page 229).

Weedy pond near Soda Butte Creek, September 1, 1891:

- Chironomus larvæ (a few).
- Corethra larva (one).
- Ephemerid larvæ (several).
- Cyclops sp. (one).
- Simocephalus vetulus (very many).
- Ceriodaphnia sp. (very many).
- Daphnia pulex (many).
- Annelida (one, fragment).

Standing pools left by Soda Butte Creek; covered with algæ; muddy bottom; Sept. 1, 1891:

- Hydroporus sp. (one).
- Chironomus larvæ (a few).
- Ephemerid larvæ (many).
- Phryganeidæ (small, one).
- Podurid (great quantity on algæ).
- Gammarus (one).
- Cyclops sp. (one).
- Daphnia schœdleri (many).
- Simocephalus vetulus (very abundant).
- Ceriodaphnia reticulata (many).
- Physa sp. (large, two).
- Chætogaster sp. (one).

Two circular ponds, each approximately 500 feet across, situated about a mile from Baronette's Bridge and beside Lamar River, were examined in passing, so far as could be done by alongshore work and by wading out with a surface net. In one there was an abundance of vegetation—rushes and a variety of other water weeds—and no appearance of alkaline deposit, the bottom being a film of mud on gravel. In the other there were no rushes, but the water was sufficiently alkaline to have a smooth feeling, and the dead water weeds were whitened as they lay upon the bank.

In the first pond, there was a great quantity of dead shells of a large *Planorbis*, and fewer of a large *Limnæa* around the margin. Vast numbers of *Allorchestes dentata* occurred on the vegetation, and especially in the soft mud of this pond. The entomostraca were nearly all *Copepoda*, of the genus *Diaptomus*, most of them *D. lintoni*. Not a single *Cyclops* was noticed, nor a single *Daphnia*. A few *Ceriodaphniæ* occurred, several specimens of *Simocephalus vetulus*, a very few of *Chydorus sphæricus*, and, for the rest, a considerable number of hydrachnids, a few *Chironomus* larvæ, and several larvæ of dragon-flies (*Agrion*). With the foregoing were the common large *Corisa* of this region, *Notonecta*, *Physa*, *Deronectes*, and a small hydrophylid larva.

In the alkaline pond near by were a very few mollusks and a moderate number of insects, the latter consisting chiefly of agrionine larvæ and small larvæ of *Chironomus*. The entomostraca were much as before, except that *Diaptomus shoshone* in small numbers mingled with *D. lintoni*.

MADISON RIVER SYSTEM.

Although large collections were made from streams of various sizes whose waters find their way into the Missouri by way of the Madison, the only lakes so connected upon which we worked were Mary Lake and Grebe Lake, the former draining through Nez Percé Creek into the Firehole, and the other giving origin to the main branch of the Gibbon.

Mary Lake.—This little lakelet, situated at a level of 8,200 feet, on the divide between the waters of the Firehole and those of the Yellowstone, is an oval body of water some 5 or 6 acres in extent, clear but shallow, with a fine gravelly beach and very little vegetation. The immediate banks are rather steep, and the country around is densely wooded with pine. The greatest depth at our visit was only 20 feet, and a lagoon-like bay near the lower end was but 5 or 6 feet deep. Both inlet and outlet—the former very small—were dry, but the lake overflows into Nez Percé Creek when the snow goes off in spring.

Our collections from this lake were particularly remarkable for the great number of one of the most beautiful and interesting of our fresh-water entomostraca, the species known as *Holopedium gibberum.* In a haul made with the towing net at the surface, in the shallow water near the outlet, a great quantity of this species was taken, together with a still greater number of *Diaptomus lintoni* and an occasional *Corethra* larva. The sun was shining at the time (11 a. m., August 14) and the water was rippled by a light breeze. Near the bottom, at a depth of 16 feet, *D. lintoni* was the prevailing form, mingled, however, with an almost equal quantity of *Corethra* larvæ and a considerable number of *Daphnia schœdleri.*

The deeper bottom was of sandy mud, which contained a large number of *Chironomus* larvæ in tubes—most of them the common large red species—a great number of the common form of *Pisidium,* and many caseworms with tubes composed of sand grains, several of them bicarinate. The dredge brought up a little *Spongilla*, several of the usual annelids, and *Corethra* larvæ, but no living vegetation. No amphipods were taken from the lake, and no univalve mollusks. An unusual number of aquatic insects occurred alongshore, most of them specimens of *Agabus* (two species) and *Deronectes griseostriatus.* The leeches were, as usual, several species of *Clepsine* and *Nephelis maculata.*

Grebe Lake.—This shallow, muddy lake, connected with the head waters of Gibbon River, is so far secluded within the forest that it has no current name, and is locally almost unknown. We reached it August 27, with saddle and pack animals, from the Grand Cañon Hotel, carrying canvas boat, seines, and our smaller apparatus.

Our collections were made with a surface net in deep and shallow water, with a dredge at a depth of 36 feet (the greatest found), and with the hand net from grass and lily pads near the margin, from the gravelly bottom in shallow water, and from weedy mud—this list exhausting, in fact, all the varieties of situation offered.

The lake lies north and south in greatest length, the outlet leaving the south end and flowing to the south at first. It is in some respects a duplicate of Mary Lake, but is somewhat larger, being half to three-quarters of a mile long and about two-thirds as wide. It is of oval form, with grassy margins, commonly sod to the water's edge, rimmed round with lily pads and other water weeds, and with a bottom of soft, black mud. The banks were somewhat swampy, but the ground was higher to the north and west. Three small streams flow into the lake, one from the northeast and two from the west.

Although so unlike Shoshone Lake, its assemblage of animal forms bore a striking resemblance to that of the larger, clearer lake. The absence of fish, the abundance of *Gammarus* and *Diaptomi*, and the scarcity of *Daphniidæ* are examples. On the other hand, the grassy borders and weedy shallows entertained a much greater abundance and variety of insect forms than the hard and bare margins of either Shoshone or Mary Lake.

In the mud of the bottom were many large red *Chironomus* larvæ, a few specimens of *Gammarus*, and the usual *Pisidium*. The entomostraca were mostly *Diaptomus lintoni*, which replaced in this small lakelet the *D. shoshone* of the other lake; here also we found *Daphnia clathrata*, n. s., the only locality thus far discovered for it. It was not abundant in Grebe Lake, and may have bred primarily in the swamps adjoining. A species of *Cyclops* also occurred here in small numbers, which is described on page 248 as *C. capilliferus*.

Inshore collections were unusually fruitful. *Gammarus* and *Allorchestes* were very abundant along the margin in the weeds and grass, and *Pisidium* especially was extraordinarily common. Here also were agrionine and ephemerid larvæ, caseworms with cases of fine sand, *Corisa*, *Pisidium*, *Physa*, *Chironomus*, and *Spongilla*, and on the mud among grass and algæ were dytiscid and small sialid larvæ, *Physa* and *Pisidium*, *Nephelis* and *Clepsine*, *Allorchestes* and *Gammarus*, *Chironomus* and ephemerid larvæ, larvæ of dragon-flies, and specimens of *Haliplus*.

This lake was an additional illustration of the fact that, in this high mountain region, where aquatic life seems oppressed with unusual difficulties, change in circumstance takes extraordinary effect, so that each lake has its distinct and special zoölogical character.

FLATHEAD RIVER SYSTEM.

The waters of the Flathead region from which collections were made by us were Swan and Flathead lakes and Flathead, Swan, and Cœur d'Alene rivers, and the Jocko at Ravalli. Those from the lakes only can be here discussed.

Flathead Lake.—Although this lake stands in some respects in decided contrast to Yellowstone Lake, these differences tend largely to neutralize each other. Flathead Lake is over 200 miles farther northward than Yellowstone, but the latter is 4,775 feet the higher above the level of the sea. These lakes lie on opposite continental slopes, their waters passing respectively into the Gulf of Mexico and the Pacific Ocean, but neither is more than a few miles from the relatively low continental divide, easily passable by most of the plant and animal forms likely to occur in such waters. Both lakes lie in the course of streams of considerable size, but these streams flow in opposite directions, the inlet of Flathead Lake coming southward from the British Possessions, and its outlet running first to the south and then to the west as Flathead River, a branch of the Columbia, while Yellowstone River, rising about 50 miles above the lake, runs northward more than a degree below it before swinging to the east to join the Missouri. Nevertheless, the headwaters of the two river systems interlace almost inextricably through interlocking mountain valleys along several hundred miles of the main Rocky Mountain range. Both lakes lie among mountains from whose rugged gulches the snow never wholly disappears, and both are bordered by forests broken by park-like openings on the lower slopes; but the geological structure of the surrounding country and the chemical composition of the rocks which form their shores and beds differ widely for the two, and the forests, all pine and fir and other conifers around Yellowstone Lake, are largely deciduous trees about Flathead.

The lakes are similar in size and are both deep enough to give a deep-water character to their interior fauna, but Flathead has much the more uniform shore-line and contains—if I may judge from the parts of it which we examined—a larger extent of shallow and weedy water. It is divided, in fact, by a chain of islands stretching across its lower third, into unlike parts; the northern deep and clear, and the southern shallow, and easily stirred up to its clayey bottom by the winds.

Finally, both lakes, like most of this region, are evidently far smaller now than they were in an earlier geological period. The extension of the old Flathead above the present lake is shown by the terraces marking its former shores, which may be traced, one above the other, for a considerable distance above the inlet; while Hayden Valley, the deserted part of the Yellowstone Lake, lies below the lake along its present outlet.

The Flathead is reported by steamboat men and residents to be about 25 miles long by 10 or 12 wide, although the best published map of the region makes it 24 miles long by 17 wide; but as the country about has not yet been surveyed, neither distances nor proportions are precisely known.

The immediate surroundings of this lake are attractive in the extreme. Beside it on the east lies the Mission Range of mountains, beginning to rise almost from the water's edge, and presenting to a near view, along the lower half of the shore, a curiously regular series of high, scantily wooded ridges and rocky gulches transverse to the length of the lake. Further back the peaks of the higher mountains rise bare and steep. This Mission Range diminishes in height northward, and falls away to Swan River, near the northeast part of the lake, but across the river to the east and north the Kootenai Range continues far up along the Flathead. Opposite Mission Range, on the western side of the lake, lies a mass of heights between mountain and hill, rising one above another, mostly wooded, but with occasional park-like openings. Above the lake a level valley several miles wide, partly densely wooded and partly prairie, extends above Kalispell, and to the south lies the naked plateau of the Flathead Reservation.

The principal tributaries are the Flathead, a still, broad river, larger than the Yellowstone at the lake, running from Demersville, most of the way between flat, low banks; the Big Fork or Swan River, a rocky stream, whose course from Swan Lake to the Flathead is an oft-repeated alternation of wild rapids and comparatively quiet reaches; and Dayton Creek on the west, which I did not see. The outlet (Flathead River) flows rapidly away from the lake between bluffy banks which presently become a cañon.

Although this lake lies in a great trough-like valley, the level of much of which is not far above that of the lake itself, there is scarcely any swampy ground in its vicinity, or weedy standing water connected immediately with it or with its tributaries in the vicinity of the lake. The principal breeding-grounds of fish, in fact, appear to be upon these streams at a considerable distance from Flathead Lake, so that for most of the species there is a long migration period.

Our systematic work in the lake was all done in and about the northeast bay in the vicinity of the mouth of the Big Fork, and at the lower end near the outlet.

While on this bay we were the guests of Mr. E. L. Harwood, of Demersville, and of the Helena Rod and Gun Club, whose club-house on the bay was our home, while a steam launch belonging to members of this club afforded the only possible means of access with our apparatus to the deeper waters of the lake.

At this locality, where we remained from the 20th to the 22d of September, two dredgings were made, the first beginning at 76 feet and continuing to 125 feet, and the second beginning at 125 feet and continuing to 153 feet. The surface net was hauled from 8 a. m. to 9 p. m., in deep and shallow water, and collections were made with nets and by hand alongshore, among the weeds, from driftwood, and from stones.

Our only temperature observations were made at noon of a bright day (September 22), with a common thermometer only, as no deep-sea thermometer was furnished for this trip. At this time the temperature of the air was 70° F., that of the water at the surface 68°, and that of the mud brought up in the dredge, in a haul commencing at 125 feet and stopping at 153 feet, was 42°.

At the lower end of the lake a heavy storm made work difficult, but we searched thoroughly a rocky flat at the outlet, and collected from the masses of weeds washed up by the waves and from the weedy shallows along the southeast shore.

The open-water collections in Flathead Lake were very similar in general character and in the relative numbers of the principal groups to those in Yellowstone Lake, but the species were all different. In the former lake the so-called *Daphnia pulex* was not once seen, but this species was replaced by a *Daphnia* allied to *hyalina*, and here described as *thorata*. This entomostracan made probably four-fifths to ninetenths of the product of every deep-water haul with the surface net. *Diaptomus*, the next commonest form in Yellowstone Lake, was not certainly seen at all in Flathead, but was replaced by a new variety of *Epischura* (*E. nevadensis*, var. *columbiæ*), which held practically the same relation to *Daphnia thorata* which *D. sicilis* held to *D. pulex* in the other lake. Besides these most abundant pelagic forms we found only occasional examples of *Leptodora*, *Cyclops*,* *Bosmina*, *Scapholeberis*, and *Sida crystallina*, the last two shore forms which probably would not have been taken very far out. Between the deeper waters and the weedy northern margin of the northeast bay is an extensive flat of sand, under from 5 to 15 feet of water, and here our tow-net hauls were always remarkably unproductive. Partly, perhaps, because of the barrier offered by this barren belt of shallow water, the pelagic *Crustacea* did not appear at all in our alongshore collections as they did in Yellowstone Lake. The assemblage of forms brought out by the small amount of work inshore which we had time to do, was in no way remarkable, unless for its deficiencies. *Gammarus* and *Allorchestes dentata* among the amphipod crustaceans, *Sida*, *Eurycercus*, and *Cyclops gyrinus* among the entomostraca, species of *Physa*, *Limnæa*, and *Planorbis* among mollusks, and the usual miscellany of hydrachnids, ephemerid and *Chironomus* larvæ, larvæ and adults of *Dytiscidæ* and *Hydrophilidæ*, *Corisa*, planarians, leeches, and annelids—among the latter, *Pristina lacustris*—were the commoner kinds.

Our first dredging in Flathead Lake was made about 200 yards from land, off the mouth of a small cove with bluffy shores—the first below the Helena Club House—in water ranging from 76 to 125 feet. The dredge came up, after a haul of about a quarter of a mile, well filled with soft mud, mostly of slaty color, but somewhat streaked with reddish brown and mixed with a considerable débris of particles of dead wood, fragments of dead leaves, cast skins of insect larvæ, and the like.

The greater part of the zoölogical product of this haul was a mass of the cœnecium of a species of polyzoan (*Plumatella*, near *arethusa*), and with these came *Chironomus* larvæ, red and pale, a dozen specimens of *Pisidium*, a few cyprids, and a number of undetermined, slender, pale-red, annelid worms, 2 to 3 inches long and a millimeter in diameter.

The second dredging was made in the same vicinity, but a little below the preceding and farther out. Beginning about half a mile out from the head of the same cove, at a depth of 125 feet, we hauled nearly a mile to south and west, taking up the dredge at a depth of 153 feet, when about three-fourths of a mile from the point forming the southern limit of the cove. This haul yielded precisely the same product as the other—an abundance of the same species in approximately the same ratios.

Neither in variety nor quantity was the animal life of the deeper waters of this lake, as shown by our work with the dredge and towing net, at all in advance of Yellowstone Lake, with the single exception of the polyzoan of our dredgings, and this was possibly only a local accident.

The bottom and margins of the southern end of the lake seemed comparatively barren, the weeds washed ashore containing, in fact, scarcely anything but *Allorchestes dentata*, dytiscid and ephemerid larvae, and *Corisa*. From the stony flat at the outlet a considerable supply of caseworms of several species was obtained, *Corisa*,

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*Mostly a species undescribed, allied to *thomasi* of the Great Lakes, but differing in its more slender, more loosely articulated form and in the armature of some of its legs.

water beetles (*Hydrophilidæ* and *Dytiscidæ*), and perlid and ephemerid larvæ, together with a number of leeches—both *Clepsine* and *Nephelis*—*Physa*, *Limnæa*, *Planorbis*, *Pisidium*, *Gammarus*, *Plumatella*, and a fresh-water sponge (*Spongilla fragilis* Leidy).

Swan Lake.—This lake, visited August 24, lies in the course of the river of the same name, about 8 miles from our camp on Flathead Lake. It is a long and narrow lake—about 12 miles long by 1 to 3 miles wide, according to our guide—lying deeply secluded between two lofty mountain ranges, Mission Range on the west and the Kootenai on the east. Its waters are clear and its bottom is extremely irregular, if one may judge from the soundings made by us at the lower end, for some 2 miles above the outlet. The deepest water (not exceeding 30 feet) lay off the highest points, where the mountains come down to the water's edge, or in pot-holes and winding irregular channels, with weedy bars and banks between. At the upper end, the lake is said to expand to its greatest width and to be surrounded by meadows and marshy flats with water weeds extending a long distance out; and there are similar weedy flats along the shore below, especially at the mouths of creeks. Swan River, above the lake, was also reported to be marshy for some distance up, as is also Spring Creek, emptying near the head of the lake. About half a mile above the outlet were two small islands with gravel beaches and surrounded by shoal water full of rushes and a good growth of other aquatic plants.

The animal species in the deep open water of this lake were precisely the same as those commonest in the larger lake below; namely, *Daphnia thorata*, *Epischura nevadensis*, var. *columbiæ*, taken in numbers, and *Leptodora hyalina*, occurring only occasionally. These pelagic entomostracans were, however, much less abundant in Swan Lake than in the larger, deeper body of water.

The bottom forms were not collected by us, as we had brought no dredge, but the surface net was hauled repeatedly among the weeds in water about 10 feet in depth, and stones, round and small, around the margins of the islands were thoroughly searched. Among the weeds, the commonest entomostraca were *Sida crystallina*, *Eurycercus lamellatus*, and *Cyclops gyrinus*—the latter numerous—and with these occurred a very few specimens of *D. thorata* and of a species of *Alona* undetermined. A few small *Chironomus* and ephemerid larvæ, *Corisa*, *Agrion* larvæ, *Allorchestes dentata*, *Physa*, *Planorbis*, *Hydrachnidæ*, several bristled annelid worms, and a small leech, were also taken here. From the stones along the margin of the island we took great numbers of *Gammarus* and *Cypris*, a very fine sponge occurring in thickish masses on the rocks (some white and some chlorophyl-green), a branching polyzoan (*Plumatella*) clinging to the stones, several species of leeches,—including *Nephelis maculata*, so common in the Park,—planarians, specimens of *Physa*, *Planorbis*, and *Pisidium*, and the usual aquatic insect forms, larval and adult; viz, larval *Ephemeridæ* and *Chironomus* and other small dipterous larvæ, *Corisa*, aquatic *Coleoptera*, *Hydrophilidæ*, *Dytiscidæ*, and several kinds of caseworms. These alongshore collections were, in fact, decidedly larger and more varied than those from Flathead Lake, a fact doubtless to be explained in part by the relatively greater amount of shallow weedy water, and the consequent greater abundance of minute plant and animal life.

DESCRIPTIONS OF SPECIES AND VARIETIES.

CLADOCERA.

Daphnia clathrata, n. sp.

A species of moderate size, with short, deep head, medium to very long posterior spine, minute pigment speck, and pectinate tarsal claw. In the immature female there is a prominent angle just above the swimming antennæ, like that of *D. dentifera.*

In the adult female the head, measured vertically across the rostrum, is twice as deep as its length from the base of the antenna to the middle of the front. It is sharply keeled rather than crested, very broadly rounded, its lower margin very slightly convex or quite straight, and its rostrum well marked in the adult.

The eye is close to the front, the transparent orbit reaching to the margin of the head, of medium dimensions, its antero-posterior diameter contained twice in the space between the eye and the posterior margin of the head. The pigment speck is very minute, placed behind the lower half of the eye and nearer the posterior margin of the head. The fornices are not prominent. Beginning midway between the antenna and the eye, they arch broadly above the base of the former, making an obtuse angle a little beyond the antenna, and continuing as a slight carina backwards and downwards for a little distance on the side of the valve. The ventral margin of the shell is more broadly arched than the dorsal, the latter being, in the immature female, nearly straight from the heart backwards. The valves are conspicuously quadrangularly reticulate, spinose on their lower edges nearly to the beak, and on the upper edge to the vicinity of the heart. The posterior spine is very long, straight, slender, spinose to the tip, contained in average cases not more than twice in the length of head and body without the spine.

The antennæ are rather short, about half as long as the distance from the posterior margin of the eye to the base of the posterior spine. The swimming hairs are two-jointed, the basal joint the shorter. The dorsal abdominal processes arise in immediate connection, but are not united at their base. The anal furrow has about a dozen teeth on each side, and the caudal claw has a comb of three or four conspicuous teeth at its base, besides a little group of smaller ones.

Length of an ovigerous female, 1.7 millimeters to the base of the spine; the greatest depth, 0.85.

The male was not seen.

Occasional in Grebe Lake, Yellowstone Park.

Daphnia arcuata, n. sp.

Head helmeted, rounded in front, length one third that of the shell, front concave, beak produced, extending beyond the sensory hairs of the antennæ. Fornices beginning above the eye and extending nearly to the middle of the back, not especially produced above the antennæ. Eye small, about midway between the mandibles and the front of the head, and about midway between the tip of the beak and the dorsal surface of the head. Pigment speck very small, less than half the diameter of a lens of the eye, and placed midway between the eye and the posterior margin of the head. The latter concave, the beak extending backward and applied against the margin of the shell. Swimming antennæ reaching the middle of the shell, their hairs moderately robust, the first segment not longer than the second. No emargination separating head from body, but the dorsal surface very slightly sinuate there. Abdominal processes all distinct, anterior much the longest. Caudal claw with accessory teeth, about six in number, the three proximal the largest. Anal spines about ten. Posterior spine of the shell given off from the middle of the valves, in the adult female a third to a half as long as the valve. Shell moderately coarsely marked in quadrangular areas, the lower and dorsal margins spinulose from the middle backwards. Length 2 millimeters, depth 1 millimeter.

Heart Lake, Yellowstone Park, Wyoming.

Daphnia thorata, n. sp.

This species belongs to the *hyalina* group, and may possibly be entitled only to varietal rank. The distinctness and constancy of its characters, however, in collections made by us in Flathead and Swan lakes in western Montana, and the number of minor points in which it differs from *hyalina*, as most recently described, lead me to distinguish it here as a specific form.

It is oval in outline; the long and slender posterior spine is placed at or a trifle above the middle; the length of the head is about a third that of the valves of the shell excluding the spine, and there is no trace of dorsal emargination between head and body. The head is narrowed toward the base and elongated forward in a way to give it the outline of a high bell jar with a flaring base. Its front is broadly and regularly rounded, its ventral margin usually conspicuously concave and closely like the dorsal, although occasionally the head is straight or convex beneath. The posterior margin is either straight or slightly concave, and the beak stands free from the front margin of the valves, and by its extension downward not only covers the antennæ but reaches clearly beyond the tips of the sensory hairs. The eye is of medium size, placed far back of the front of the head and equidistant from the tip of the beak and the dorsal junction of the head and body. The pigment speck is of moderate size, placed directly behind the eye, and much farther from it than from the posterior margin of the head.

The antennæ are moderately stout, entirely smooth except for inconspicuous transverse rows of minute appressed hairs upon both peduncle and rami, and a row of short, tooth-like spinules at the distal end of each segment. The swimming hairs are rather slender, the second joint commonly decidedly shorter than the first.

Fornices slight, arising above and a little behind the eye and terminating directly behind the antennæ, above the bases of which they project but slightly. The lower margin of each valve is set with the usual spinules almost to the beak, and the dorsal margin is similarly armed for a distance in front of the spine about equal to half the length of the latter. The valves are marked off by fine lines into large quadrate meshes.

The dorsal abdominal processes rise separately, the two anterior, however, in immediate contact at their bases. The first of these is decidedly the longer, but the third process is distinct, although low. The anal setæ are two-jointed, the second joint the shorter. The abdomen is regularly narrowed backwards, and the anal groove is provided with twelve to fifteen teeth on each side, commonly the latter number. The terminal claws are without accessory comb. The intestinal cœca are short, not longer than the diameter of the eye, and extend directly forward.

Length, 2 millimeters to 2.5 millimeters; depth half the length, sometimes a little more. Length of spine somewhat variable, but commonly about equal to the depth of the shell.

Described from females only.

Abundant in Swan and Flathead lakes, Montana.

Daphnia pulex, var. pulicaria, n. var. (Plate XXXVII, Fig. 1.)

Similar, especially in the female, to typical *D. pulex*, to which it is closely related by its more general characters. Body a broad oval, moderately thick, colorless, commonly without dorsal emargination between the head and thorax, although sometimes in the generation of females bearing ephippia there is a broad concavity just above the heart. The lower border of the head is broadly concave and the beak is long and applied against the anterior margin of the shell. Moderately long posterior spine placed above the middle line; caudal claws with two sets of teeth, and with 14 to 17 curved spines at the anal furrow.

The head of the female is small, somewhat depressed, crested, as in *D. pulex*, the crest extending backward to the middle of the dorsum; fornices terminating posteriorly opposite the heart, and extending anteriorly to the eye. The beak projects a little beyond the tips of the sensory hairs; the eye is large, its vertical diameter contained scarcely twice in the distance from the eye to the tip of the beak, placed close to the broadly rounded anterior margin of the head, and provided with many large lenses. Pigment speck of moderate size, midway between the eye and the posterior margin of the head.

Antennæ but moderately developed, destitute of scale-like appendages like those of *pulex*, but set with inconspicuous transverse rows of rather slender hairs. Swimming hairs moderate and moderately feathered, three-jointed, the third segment very short, but evident. The cæcum of the intestine strongly curved, extending at first obliquely downwards towards the middle of the eye, and then turning almost directly upward at an acute angle, terminating midway between the middle of the upper margin of the eye and the front of the base of the antenna. The surface of the valve is marked with quadrate areolations, and the margins, both dorsal and ventral, are provided with backward-projecting spines or thorns as far as the middle. The anterior half of both margins smooth. The posterior spine is variable in length, reaching in adult females a fourth the entire length of the head and body.

Dorsal processes of the abdomen distinct, the two anterior contiguous in their origin, not united at their base, the first the longer, smooth, and directed forward, the second hairy, turning backward. Two others in the form of low elevations, the last inconspicuous, but both hairy.

The abdomen is rather broad, the posterior margin broadly rounded, the anterior margin straight; 13 to 17 spines bordering the anal furrow, length regularly increasing from above downwards; the teeth of the caudal claw in two groups of from four to six each, the upper group very much the smaller; the anterior margin of each claw with two distant slight emarginations, as in *D. pulex*.

Length of an adult female 1.9 millimeters without the spine; depth, 1.1 millimeters; spine 0.5 millimeter. Female bearing ephippium, a little deeper (1.2 millimeters).

The male smaller, narrower, with head more depressed, the dorsum especially more nearly straight, and the posterior spine standing higher, continuing the line of the dorsum backwards. The lower margin of head is only slightly concave, the posterior half of it straight. A slight beak is formed just below the sensory antennæ, the latter being attached at a small angular emargination at the posterior angle of the head. From this emargination the posterior margin of the head passes directly upwards in a broad and gentle curve. The eye is very large, placed at the very front of the head. Its longitudinal diameter is contained but once in the head behind the eye. Sensory antenna slightly clavate, slightly expanded at the middle, its length equal to the vertical diameter of the eye. In front of the terminal group of sensory hairs is a long terminal spine, nearly as long as the antenna itself, slightly curved backwards and segmented at the middle. Accessory hair distant from end, but a little below the middle.

Length without spine, 1.4 millimeters; depth 0.9 millimeter; spine, 0.33 millimeter. A single hairy dorsal abdominal process, as in *pulex*.

Yellowstone Lake and other waters of Yellowstone Park.

Daphnia dentiferà, n. sp. (Plate XXXVII, Fig. 2.)

This species is broad oval in form, has a long beak and a very large eye, a posterior spine placed high up, and in the male and young female a prominent angle on the dorsal outline between heart and eye.

The head is broadly rounded, with eye close to the front margin. The fornices are short, rising above and behind the eye and extending backwards a little beyond the base of the antennæ, where they form a prominent angle. Thence a slight lateral keel of the valve is continued downwards and backwards a distance about equal to the length of the fornix. The lower margin of the head is broadly concave, the beak produced, projecting as far as the ends of the sensory hairs. The large eye, with numerous lenses, is contained not more than twice in the distance from eye to beak, its diameter a little greater than that of the base of the antenna at its insertion. Pigment speck of moderate size, circular, immediately behind the eye and nearer to that than to the posterior margin of the head.

The head is slightly crested, and the crest, extending backward to the heart, rises over the antennæ in a prominent, nearly rectangular process, still more acute in the young, the tip of which is commonly truncate and bears two or three teeth inclining forward. In the egg-bearing female this process is reduced to a mere obtuse angle, or, in the last generation (that bearing the ephippium), disappears entirely. In young adults this dorsal angle is midway between the eye and the heart, but when fully developed it is on a line drawn from the anterior margin of the valve to the middle of the base of the antenna. The setæ of the antennæ are all two-jointed, the basal joint distinctly the longest. The posterior spine of the carapace is long, slender, and weak, and is commonly contained three or four times in the head and body without the spine.

The margins of the valves are set below and behind with slender thorns, as is also the posterior spine, these thorns extending forward a little distance upon the dorsal margin of the shell. The curved spines bordering the anal furrow are thirteen in number; the caudal claws are without accessory teeth; the surface of the shell is marked with quadrangular areolations.

The first and second dorsal abdominal processes are about equal in length and arise in immediate contact, the anterior turning forward and the posterior backward.

Mature female 1.8 millimeters long by 1 millimeter deep.

The male of this species is smaller than the female; the head is smaller and narrower, the form is more nearly elliptical, and the dorsal angle is as prominent as in the young female, and commonly bears obscure teeth at the tip. The head is subquadrate, with rounded angles. The very large eye is at the extreme front of the head, its diameter greater than the distance between the eye and the posterior margin of the head. Below, the head is straight; the anterior antennæ are not especially prominent and the terminal spine is inconspicuous. The posterior spine is like that of the female, long and slender and dorsally placed. The abdomen is without dorsal process. Mature specimen 1 millimeter long by 0.5 millimeter deep.

Closely allied to *D. dentata* Matile, with which my friend Professor Birge considers it possibly identical. It differs, however, particularly in the form of the head, the beak of which is much more produced backward in *dentifera* than in *dentata;* in the somewhat larger eye (especially of the male); in the different form and position of the dorsal angle, and in its evanescent character in the female adult; in the greater length and slenderness of the posterior spine; and, notably in the male, in the different armature of the anterior antenna. *Dentifera* is also without the third joint of the swimming hairs of the antenna.

Pool near Shoshone Lake, Yellowstone Park.

OSTRACODA.

Cypris barbatus, n. sp. (Plate XXXVII, Figs. 2 and 3, and Plate XXXVIII.)

An extremely large, very hairy, oblong *Cypris*, with rounded ends and dorsal and ventral margins nearly parallel. Length, 4 millimeters; width, 1.6 millimeters; depth, 2 millimeters. A very little deepest at hind end of hinge margin. (Depth across eye, 95 per cent of greatest depth.)

Dorsal margin about straight for a great part of its length, the ventral margin very slightly emarginate or sinuate at its anterior third. The anterior end broadly and smoothly rounded, more obliquely above than below, the posterior somewhat obliquely rounded, the ventral margin being thus nearly half as long again as the dorsal. Seen from above the shape is symmetrical, a slender oval, a little more flattened at the sides behind than before; thickest, consequently, before the middle.

Color a dirty yellowish-brown in alcohol, with a reddish-brown patch on either side above and behind the middle. Surface of valves opaque, very minutely roughened, and well covered with conspicuous hairs, which give this *Cypris* a decidedly hairy appearance to the naked eye. Hairs longest before and behind and lengthening generally towards the margin, where they project as a fringe, the most prominent part of which is a row of hairs borne on slender conical tubercles within the margin of the valves. The valves are equal and the shell fairly full, but not plump.

Anterior antenna with the basal segment obliquely channeled, partially dividing it into two, the distal part of which bears a single bristle on its superior surface, and two long, more slender ones, springing together from the tip of the ventral surface. A short, subquadrate second segment bears a single seta, about as long as the segment, on the dorsal surface, near the tip. From the distal end of the following segment spring two long, slightly plumose setæ, one dorsal, one ventral, the former much the longer. The fourth segment bears at its tip four long setæ, two of which arise from the ventral angle and two from the outer dorsal. The following segment is similarly armed, and the distal extremities of the sixth and seventh are densely set with long plumose setæ forming a stout fascicle, which extends beyond the end of the antenna a distance equal to the length of the antenna itself.

The terminal segment of the palp of the first maxilla is a little more than a fourth the length of the basal, the latter with one subterminal bristle without, and several terminal ones. Tip of last segment with two stout, curved, claw-like setæ, and four or five smaller, softer ones. Outer lobe of maxilla proper reaching to tip of first segment of palp, nearly equaling it in diameter, also with two curved claws, shorter but much stouter than those above mentioned, three-fourths as long as the lobe itself. Besides these, two smaller setæ and three or more subterminal ones, two of which are smooth, like the terminal group, and one strongly plumose. A single plumose seta also springs from near the base of the concave surface of this lobe. The second and third lobes similarly armed at tip, but with a larger number of curved setæ, all of which are soft. Two of these, on the short inner lobe, are much longer and stouter than the others, and project directly backward. The base of this lobe bears two plumose setæ about as long as those just mentioned. The length of the inner lobe is half that of the outer, the middle one being intermediate.

The second maxilla with about twelve terminal setæ, which diminish in length inward, most of them slightly plumose, and two long slender setæ, one springing from the middle of the inner margin and the other from the base. Palp thick, slender ovate, twice as long as the masticatory lobe, fringed with a soft silky pile, and bearing three more or less plumose setæ at its tip, the middle one of which is the longest. Branchial lobe very small, semicircular, with three fully developed plumose setæ nearly as long as the palp, and two much shorter ones, one delicate and smooth, the other stout and plumose.

The basal segment of the second antenna trigonal, with one moderately long hair beneath, and two of similar length springing together from the inner side of the apex. The second segment subcylindrical, with two hairs diverging from the middle of the outer side of the apex, the under one of which is very short and weak, about as long as the third segment is wide, while its companion reaches about to the tip of that segment. On the inside of the tip of the second segment is another hair, similar to the above, and of about the same length. The third segment bears, at the union of its basal with its middle third, on the under side, set beyond a slight tooth-like projection, a jointed olfactory club, whose length is about two-thirds the diameter of the segment. Otherwise this segment bears no hairs except at the tip, where, upon its inferior angle, is one long, stout hair, reaching beyond the tip of the last joint, and upon its inner surface a fascicle of five plumose hairs, the four longer of which are curved and parallel, while the fifth is short and straight. The third segment is slightly longer than the second and about two-thirds as thick. The fourth segment is three-fourths the length of the third and about two-thirds its diameter, slightly enlarged at the middle, where it bears, on the under side, a group of three long hairs, and upon the upper side two shorter ones. At the tip of this segment are a group of three long plumose hairs and a stout, curved, concave, acute claw, nearly three times the length of the last segment, doubly dentate on both edges. At tip of last segment the usual strong, curved, bidentate claws, five in number, three of equal length, as long as the two last segments of the antenna, and two others about half that length.

Mandible with a row of six dark corneous teeth, more or less bifid, the series continued in an irregular cluster of tooth-like spines, and terminating in two highly plumose setæ. The series of teeth with numerous accessory smaller teeth and spines, and two transparent lamellæ—slender, but as long as the teeth themselves—inserted between the first and second and the second and third series, respectively. The latter lamella is recurved and serrate on its concave edge. Basal segment of the palp longest, the third next, second and fourth subequal in length, the second as broad as the first. The latter bears at its posterior tip three plumose setæ of unequal length, in a cluster, and a fourth larger, stouter, decurved articulate one, inserted on the outer side of the tip of the segment. The second segment has in front a group of three slender setæ inserted a little behind the tip; and opposite to them upon a stout tuberosity another group of three long equal setæ, to which a fourth stands in the same relation as on the preceding segment. On the third segment is a group of five setæ similar to those on the anterior margin of the segment preceding, and, in addition, a circlet of six, attached around the posterior and inner margin of the end of this segment. At the tip of the palp are three curved claws, averaging as long as the two preceding segments together, with some slender setæ intermixed. The so-called branchial appendage is about as long as the basal segment of the palp, and bears four stout plumose setæ with a small accessory seta in front.

First leg with basal segment columnar, distal portion partially separated, without hair or bristle. Second segment cylindrical, its surfaces smooth except for numerous transverse rows of exceedingly fine short setæ, present also on the two succeeding segments of this leg. A stout bristle at anterior distal angle. Third and fourth segments nearly equal (the third, however, somewhat the longer), together slightly longer than the second, the length of each about twice its transverse diameter. The third with a single apical hair at the anterior angle, and the fourth with but two, one of which is as long as the segment itself, and the second about half that length. Terminal segment with a very long, slender, symmetrically curved, regularly tapering claw, with two short soft setæ springing from its base. The entire claw somewhat longer than the last three segments conjointly.

Caudal rami long and slender, slightly sinuate, the transverse diameter of each not more than one-twentieth its length; the basal fifth, however, considerably thickened. Rami smooth, except posteriorly, where the margin is closely set with stout, short spines, lengthening toward the distal end of the ramus. Terminal claw slightly curved at tip, contained two and a half times in the length of its ramus. Subterminal claw nearly two-thirds the length of the terminal, also slightly curved. Claw-like seta almost immediately above the latter, more slender, but two-thirds its length. Besides the above, a short slender seta springs from in front of the base of the terminal claw.

The first and last segments of the second pair of legs subequal, each two-thirds the length of the second; basal segment straight, its length five times its width, with three slender setæ, one borne upon the middle of its exterior side, and two near the apex, opposite each other. Second segment slightly curved, with a single slender seta near the apex, on its outer margin. Third segment with two terminal setæ, one nearly straight, and claw-like, about three-fourths the length of its segment, and the other curved and blunt.

This species may be the same as *C. grandis* Chambers*, which it certainly seems to resemble closely, but from which it differs, if I may judge from the published brief description and rude figures, in color, surface, form, arrangement of antennal setæ, and other minor details.

Yellowstone River, Yellowstone Park, Wyoming.

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* "New Entomostraca from Colorado," in Bull. U.S. Geol. and Geogr. Surv., vol. III, No. 1, p. 151.

COPEPODA.

Cyclops minnilus, n. sp.

A small slender species, with seventeen-jointed antennæ, with narrow and loosely articulated cephalothorax and salient thoracic angles, slender abdomen, long and narrow furca, and but two well-developed caudal setæ for each ramus. The antennæ reach to the posterior margin of the second distinct segment, and are of very nearly the length of the abdomen (including furca, but excluding the caudal setæ). The greatest width of the thorax is contained two and one-third times in its length, and the furca is very nearly half the length of the remainder of the abdomen. The diameter of a ramus is about one-seventh its length.

The rudimentary inner caudal seta is a trifle longer than the outer, and about a third the length of the ramus; the longest seta as long as abdomen and furca; the next in length less than half the longest.

The last segments of the thoracic legs are armed as follows:

First pair: outer ramus, one spine and two setæ at tip, two setæ within, and one seta without; inner ramus, one spine and one seta at tip, three setæ within, and one seta without.

Second pair: outer ramus, one spine and one seta at tip, three setæ within, and two spines without; inner ramus, one spine and one seta at tip, three setæ within, and one seta without.

Third pair: outer ramus, two spines and one seta at tip (second spine twice as long as first), three setæ within, and one spine without; inner ramus, one spine and one seta at tip, three setæ within, and one seta without.

Fourth pair: outer ramus, two spines and one seta at tip (second spine twice as long as first), three setæ within, and one spine without; inner ramus, two spines at tip (one twice as long as the other), two setæ within, and one seta without.

Rudimentary legs of fifth pair distinctly articulated, basal article with a long seta at its outer distal angle, and second article with two setæ at its blunt tip, the outer the longer.

Duck Lake.

Cyclops serratus, n. sp.

A very long, narrow, loosely articulated species, with strikingly salient thoracic angles; cephalothorax broadest far forward and lobed in front, between the seventeen-jointed antennæ.

Abdomen long and slender, with very long and narrow caudal rami, and but two developed caudal setæ to each ramus. The first segment is but little longer than wide (eight to seven), is broadest across the middle, and excavate in front at the base of each antenna, leaving a thick, median, projecting lobe. The second segment is nearly a fourth as long as the first, and but little narrower, broadest across its posterior angles, which, though blunt, are so strongly salient that the lateral margins are decidedly sinuate. The third segment is as long as the second, but narrower, and with its sides more nearly parallel. The fourth and fifth segments are progressively shorter and narrower, the latter being trapezoidal, as seen from above, and separated from the first abdominal segment by a deep acute emargination.

The abdominal segments are as long as the cephalothoracic segments two to five taken together, and the furca is as long as the last three segments. The first segment of the abdomen is broadest in front, where its width is nearly as great as its length. The second is as broad as long, the third and fourth equal, the fifth a little shorter, the last with a row of fine spinules around the base of the rami.

The width of each ramus is contained nearly eight times in its length. Besides the lateral spine—situated a little before the posterior third of the ramus—there is a cluster of two or three minute spines at its anterior fourth. The outer and inner terminal setæ are reduced to short subequal spines about twice as long as the ramus is wide. The other setæ are slender, plumose, the inner nearly twice as long as the outer of each pair.

The antennæ are rather stout and short, seventeen-jointed, reaching to the end of the second segment. They are without special structures or appendages.

The last segments of the thoracic legs are armed as follows:

First pair: outer ramus, one spine and two setæ at tip, two setæ within, and one spine without; inner ramus, one spine and one seta at tip, three setæ within, and one seta without.

Second pair: outer ramus, one spine and one seta at tip, three setæ within, and two spines without; inner ramus, one spine and one seta at tip, three setæ within, and one seta without.

Third pair: outer ramus, two spines and one seta at tip (one spine twice as long as the other), three setæ within, and one spine without; inner ramus, one spine and one seta at tip, three setæ within, and one seta without.

Fourth pair: outer ramus, two spines and one seta at tip (one spine double the length of the other), three setæ within, and one spine without; inner ramus, two spines at tip (one double the length of the other), two setæ within, and one seta without.

The fifth pair is two-jointed, the basal joint broad, quadrate, with a seta at its outer angle; the second cylindrical, with one long and one short seta at tip.

Length, without setæ, 1.34 millimeters.

Described from females only.

Cyclops capilliferus, n. sp. (Plate XL, Figs. 14–17, and Plate XLI, Fig. 18.)

This is a symmetrical, compact *Cyclops*, with the cephalothorax closely articulated, widest at the middle, and the sides regularly convex, with the abdomen narrow and slender, with three well-developed caudal setæ, and sixteen-jointed antennæ bearing several very long setæ.

The abdomen, with caudal furca, is contained a little less than twice in the cephalothorax, and the breadth of the latter is just half its length. First segment very long, five times the length of the second; second and third equal; the fourth very short, on the median line semicircularly excavate behind. The abdominal segments in the female diminish regularly in length from first to last. The caudal rami are twice the length of the last segment and one-fourth as broad as long. The lateral seta is placed a trifle beyond the middle of the ramus; the outer terminal seta is a short naked spine; the other three are well developed and plumose. The inner and outer of these three are of nearly equal length, the latter a little the longer, the middle one much the longest one of the group.

Antenna moderate, reaching about to the middle of the second segment of the cephalothorax. Sixteen-jointed in all adult females, and further especially distinguished by the presence of very long flexible setæ upon the first, third, tenth, and fourteenth segments. Terminal setæ likewise very long. The seta borne by the first segment extends to the twelfth; that of the third reaches to the fourteenth; that upon the tenth segment extends to the tip of the antenna, and that upon the fourteenth far beyond it. All these foregoing setæ are borne upon the anterior terminal angles of their segments with the exception of that of the fourteenth, which is borne upon the posterior angle.

The first segment is as long as the two following, and very nearly twice as long as wide. The second is very short, its length one-fourth its width, and the length and width of the third are equal. Of the three terminal segments the penultimate is longest, being twice as long as broad; the antepenult two-thirds the length of the following; the last is about as wide as long.

The last segments of the thoracic legs are armed as follows:

First pair: outer ramus, one spine and two setæ at tip, two spines without, and three setæ within; inner ramus, two setæ at tip, one within, and two without.

Second pair: outer ramus, one spine and two setæ at tip (the inner of the latter slender, the outer thick), four setæ within, and two spines without; inner ramus, two setæ at tip, one within, and three without.

Third pair: outer ramus, two setæ at tip (the outer one stout, short, and spine-like), four setæ within, and two spines without; inner ramus, two setæ at tip, three within, and one without.

Fourth pair: outer ramus, two setæ at tip, four setæ within, two spines without; inner ramus, two setæ at tip, two within, and one without.

The fifth pair are two-jointed, the terminal joint with one long and one short seta at tip; the basal joint with one long seta without.

Length, without setæ, 1.2 millimeters.

Grebe Lake, Yellowstone Park.

Cyclops thomasi Forbes. (Plate XXXIX, and Plate XL, Fig. 13.)

Cyclops thomasi Forbes, Amer. Nat., XVI, Aug. (1882), p. 649; Cragin, Trans. Kan. Acad. Sci., VIII, 1881–82, p. 68 (1883); Herrick, Final Report, p. 153 (1884); Underwood, Bull. Ill. State Lab. Nat. Hist., II, 1886, p. 332; Forbes, Rept. U. S. F. C., 1887, p. 707 (1891).

A long and slender species, with seventeen-jointed antennæ, oval cephalothorax, somewhat closely articulated, slender abdomen, very long and slender caudal rami, and two developed setæ to each ramus, the longer of which is about twice as long as the shorter.

The cephalothorax is widest at about the middle, its greatest width a little more than half its length. Posterior angles not prominent or produced, except those of the last segment, which are slightly produced outwards. Sides of the first segment subparallel, rounding slightly towards the front, the segment itself twice as long as the other segments combined; the second segment shorter than the third, but longer than the fourth; the fifth reduced to a narrow linear band, as seen from above, the extremities of which project a little beyond the lateral outline.

Abdomen, with furca, a little shorter than the cephalothorax, its greatest width one-fourth of its length, including furca. First segment in the female as long as all the others together, broadest in front, its lateral outlines emarginate behind the anterior angle. Posterior margin of last segment serrate beneath and at sides; those of other abdominal segments smooth. Furca as long as the last three segments, the width of the rami about one-seventh of their length. The inner of the two longer setæ as long as the entire abdomen, the outer of the two half that length. The extreme outermost of the terminal setæ two-thirds the length of the inner; that is, about one-fourth the length of the caudal ramus. Rami slightly curved outwards, with one large spine and a few small ones a little beyond the middle of the outer surface, and a vertical comb of small spines at one-fourth the distance from the proximal end.

Antennæ of the female moderately robust, reaching about to the middle of the third segment, without special accessory structures or appendages, the three terminal segments gradually increasing in length, the antepenultimate two-fifths the length of the last. The two segments preceding the former, taken together, shorter than the last segment and about equaling the penultimate.

First pair of legs: outer ramus, two setæ at tip, two spines without, and two setæ within; inner ramus, one spine and one seta at tip, one seta without, and three setæ within.

Second pair of legs: outer ramus, one spine and one seta at tip, two spines without, three setæ within; inner ramus, one spine and one seta at tip, one seta without, and three setæ within.

Third pair of legs: outer ramus, one spine and one seta at tip, two spines without, and three setæ within; inner ramus, one spine and one seta at tip, one seta without, and three spines within.

Fourth pair of legs: outer ramus, one spine and one seta at tip, two spines without, and three setæ within; inner ramus, two spines at tip, one seta without, and two setæ within.

The outer ramus of the first leg is so foreshortened that the distal outer seta seems to be placed at the tip of the segment, but the usual tooth marking the lateral distal angle of the segment stands between this point and the seta next within, thus showing that the spine should be counted as lateral.

The terminal spines of the inner ramus of the fourth pair are unequal, the inner one a little more than half the outer.

Fifth pair of legs of two segments, the basal segment about as long as broad, with a strong plumose spine from the outer angle, the terminal segment cylindrical, twice as long as broad, with two terminal setæ, the outer of which is as long as the seta of the preceding segment, and the inner a little more than half that length.

Total length, without setæ, 1.33 millimeters; greatest depth a trifle less than one-third the length of the cephalothorax.

The common *Cyclops* of Yellowstone Lake, occurring also in various other waters of that region. This well-marked and constant species has a range at least from the Rocky Mountains to the Atlantic region, being, according to Prof. Cragin, a common species in the water supply of Boston. It is also the usual *Cyclops* of the Great Lakes.

The original description was inaccurate in two particulars: the outer distal spine of the outer ramus of the first leg was called terminal, and, by typographical error, the terminal joint of the outer ramus of the second, third, and fourth legs were said to have two setæ within instead of three.

Diaptomus shoshone, n. sp. (Plate XLII, Figs. 23–25.)

A very large and robust species. Thorax broadest in front, across the maxillæ, tapering gradually, with little convexity, to the posterior third. In the female the angle of the last segment is bifid, both projecting points being minutely spinose at tip. The first segment of the abdomen is laterally expanded; the expansion of the left side with a minute spine at the apex behind; that on the right produced at the same point into a small, prominent, rounded tubercle, 0.03 millimeter in length, about as broad as long, making this first segment somewhat unsymmetrical. This is not merely a modified cuticular appendage, but is penetrated by the hypodermis. Egg mass very large, obovate (narrowest forward).

Right antenna of male robust, the last two joints without special appendages, antepenultimate with a very long inarticulate process at its outer apex, extending beyond the tip of the penultimate, and to the middle of the last segment. The margins of this process are smooth, but it is broad and emarginate at the tip.

The fifth pair of legs of the male resemble the corresponding appendages of *Diaptomus stagnalis*, but differ notably in detail. The left ramus of the right leg is borne at the inner terminal angle of the second joint; is longer than the joint following; is armed at the apex with a few small acute spines; and bears upon its outer margin, near the tip, a broad fascicle of delicate hairs. The basal joint of the outer ramus is two-thirds the length of the second joint of the peduncle, and without hairs or spines of any description. The second joint of this ramus is about equal in length to the second joint of the peduncle, and bears at its outer margin, close to the tip, the usual stout seta, which is two-thirds as long as the joint to which it is attached. The terminal claw is not regularly curved, but is nearly straight for the basal three-fourths. The left leg is biramose, the inner ramus straight, slender, extending about to the middle of the second joint of the outer, and armed at its tip. The second joint of this ramus is as long as the first, if measured from the tip of the apical spine. This spine, seen from behind, is stout, conical, rather blunt, and has opposed to it within, projecting from the inner angle of the segment, a stout, curved seta, slightly plumose on its distal half. Between these, but more closely applied to the outer spine, is a hemispherical cushion-like elevation, set with small, short spinules. On the basal half of the inner margin of this terminal segment is also a much larger hemispherical cushion, but with longer and more slender hairs, while the terminal half of the inner margin of the segment preceding is also moderately inflated and covered with delicate hairs.

The antennæ of the female are 25-jointed, as usual, and reach to the base of the abdomen. The legs of the fifth pair closely resemble those of *stagnalis*, but have the terminal setæ of the inner rami much less developed. This ramus is a little shorter than the basal joint of the outer ramus, and of about half its diameter. It bears at its tip two stout setæ equaling the ramus itself in length, plumose under a high power, and has, in addition, at its inner tip and on the inner margin adjacent, a patch of delicate hairs and spines. The second joint of the outer ramus is as long as the first, if measured to the tip of its terminal claw. The latter is nearly straight, very slightly recurved. This joint bears a single spine at its outer distal angle, just within which is the rudiment of the third segment of the ramus, which bears two spines similar to the above, the inner of which is the longer, the outer itself being longer than the adjacent spine of the second joint. Adults of both sexes are blood-red throughout, except the egg sac of the female, which is purple.

Dimensions of female: Length to tip of caudal setæ, 3.1 millimeters; abdomen, with setæ, 1.16 millimeters; without, 0.67 millimeter; thorax, 1.95 millimeters in length; depth, 0.725 millimeter; width, 1 millimeter.

Male averaging scarcely smaller, but somewhat differently proportioned. Thorax, 1.85 millimeters in length; depth, 0.58 millimeter; width, 0.08 millimeter; abdomen, without setæ, 0.745; with setæ, 1.35 millimeters.

Especially abundant in Shoshone Lake, but occurring in other lakes and even in pools of some size in Yellowstone Park.

Diaptomus lintoni, n. sp. (Plate XLII, Figs. 26–28.)

A large red species occurring commonly with *D. shoshone*, but distinguishable from it at a glance by its different shape, its longer antennæ, its smaller size, and by characters derived from the right antenna and the fifth foot of the male. The thorax is symmetrically elliptical in shape, broadest at the middle. The posterior angles are not produced or bifid, but are each armed with a minute spine. The first segment of the abdomen of the female is not especially produced, but bears at its broadest part a minute spine on each side. The abdomen itself is very short, its length contained about three and one-third times in that of the cephalothorax. The antenna of the female is long and slender, 25-jointed, reaching a little beyond the tip of the abdomen.

The fifth pair of legs in this sex is similar to those of *D. shoshone*, but much smaller. The inner ramus is not jointed. It is longer than the basal joint of the outer ramus, bears two stout plumose setæ at its tip, somewhat shorter than the ramus itself, and has likewise at its inner tip a patch of small spines or fine hairs. The second segment of the outer ramus with its terminal claw is two-thirds as long again as the preceding segment, the breadth of the latter two-thirds its length. The third joint is indicated by a single long stout seta and one or two smaller ones.

In the male the geniculate antenna is relatively rather slender, its last two joints without special appendages, its penultimate with a slender transparent apical process, reaching about to the middle of the succeeding segment, acute at tip, but neither serrate nor emarginate. Fifth pair of legs in the male usually without internal ramus to the right leg, but this ramus sometimes represented by a small rudiment. The limb is usually slender and its terminal claw short. The basal segment of the outer ramus is nearly as long as the adjacent segment of the pedicel, and the slender second segment of this ramus is fully as long. Long lateral spines borne near the tip of this segment. The terminal claw is about two-thirds as long as the segment, is somewhat abruptly angulated near its base and slightly recurved at the tip. The inner ramus of the left leg is very stout and long, reaching almost to the tip of the outer ramus, is slightly curved outwards and has the apex minutely hairy. The basal segment of the outer ramus is thick, two-thirds as broad as long, somewhat inflated within, where it extends downward beyond the articulation with the second segment as a rounded expansion covered with extremely fine hairs. Second segment of this ramus longer than first, but only half as wide, bearing at its tip, within, a rather small, obliquely projecting cushion covered with cilia, and with two stout terminal spines, one short, blunt, straight, and smooth, the other curved and plumose, its length about half that of the segment to which it is attached.

The total length of this species is about 2.5 millimeters, excluding caudal setæ; depth, 0.42 millimeter.

This species is closely related to *D. stagnalis* Forbes, from which it differs conspicuously by its smaller size, more symmetrical cephalothorax, without prominent or bifid angles, and longer and more slender antennæ, with longer and more slender appendage to the antepenultimate segment.

In the fifth legs of the female this species differs from *stagnalis* especially with respect to the inner ramus, which is larger and longer than in the other, lacks the characteristic segmentation of *stagnalis*, and bears at its tip shorter and broader setæ. In the male the terminal claw of the outer ramus of the right fifth leg is much more slender than in *stagnalis*, and the inner ramus is much less developed. The left leg of this pair is different in a number of details, especially in the length and strength of the inner ramus and the length and dissimilarity of the setæ at the end of the outer.

Common in lakes and pools of Yellowstone Park.

Named for my friend, and companion on the trip of 1890, Prof. Edwin Linton, of Washington and Jefferson College, Pennsylvania.

Diaptomus piscinæ, n. sp. (Plate XLI, Fig. 22.)

A species of medium size and symmetrical proportions, antennæ reaching to the tip of the abdomen, cephalothorax broadest about the middle, with four distinct sutures, the posterior lateral angles not produced, but armed with two distal spines.

The right antenna of the male is without appendage to the antepenultimate joint, and the fifth pair of legs of the same sex has the inner ramus well developed on both the right and left sides. The usual length is 1.75 millimeters, the transverse diameter 0.45 millimeter; the abdomen, with furca, is a little more than one-third the length of the cephalothorax.

The fifth pair of legs of the female is without especially marked characters, except that the inner ramus, which reaches to the tip of the principal segment of the outer, is provided with two long, stout, equal setæ more than half as long as the ramus itself. The third joint of the outer ramus is aborted, and bears two short, stout spines, and the joint preceding bears a slender spine outside the base of the last. The terminal claw of this joint is simple and nearly straight, viewed in the usual position.

In the male the fifth pair of legs has a considerable resemblance to the corresponding appendages of *D. leptopus*, from which, however, this species differs by its more slender form and by the absence of the antennal hook. The peduncle of the left leg is quadrate and equal in length to the basal segment of the outer ramus, but is nearly twice as wide. The sides of this latter segment are parallel, the inner terminal angle is broadly rounded and minutely ciliate, and to the outer terminal angle is attached the second segment of the ramus. This segment is a trifle shorter than the preceding and less than half as wide, and bears at its tip a stout, blunt, conical spine, whose length is equal to that of the diameter of the ramus, and within this a long flexible hair as long as the ramus itself. The inner ramus of this leg is very long, reaching beyond the middle of the terminal joint of the outer ramus. It is slightly concave towards this ramus and terminates with a broadly rounded or subtruncate, thickly ciliate end, forming an acute outer angle and an obtuse inner one. Seen at right angles to this view, the tip is simply obtusely pointed.

The right leg of the male is without remarkable distinguishing characters. Basal joint of the outer ramus about two-thirds as long as the peduncle and nearly as wide; second joint slightly longer than the peduncle, equal to the first in width; and the terminal claw sinuate or irregularly curved. The stout seta on the outer margin of the second segment of this ramus is borne at about a quarter the length of the segment from the distal end, and is approximately half as long as the segment to which it is attached. The inner ramus is a little longer than the basal joint of the outer. It is not dilated or otherwise modified, but terminates bluntly, bearing at the tip a covering of long cilia.

The right antenna of the male is without notable distinctive characters. The antepenultimate segment is as long as the two following taken together; the fourth from the tip bears two long sword-like spines at its margin, both attached to its basal fourth; the expanded segments are well armed with conical spines, straight and curved, but without hooks.

Small lakelet near Gardiner, Montana.

Epischura nevadensis, var. columbiæ, n. var. (Plate XLI, Figs. 19–21.)

It is with pleasure that I report here the occurrence of another form of this interesting genus of North American entomostraca, the fourth or fifth thus far discovered. The first species described, *E. lacustris*, has been found in the Great Lakes, in the smaller lakes of Wisconsin and Minnesota, and at Portland, Oregon; the second, *E. fluviatilis* Herrick, has been seen only by the original describer of the species, by whom it is said to occur in Mulberry Creek, Cushman County, Alabama.* *Epischura nordenskiœldii* Lillj., is from Newfoundland, and *E. nevadensis* from lakes Echo and Tahoe, the former in California, the latter partly in that State and partly in Nevada. The present form occurs in Swan and Flathead lakes, in northwestern Montana, where it was the most abundant copepod in the open water.

The absence of all representatives of this genus from the lakes of Yellowstone Park, evidently adapted to them, hints strongly at a limit of altitude to their distribution. The highest locality from which any species has been reported is Lake Tahoe, said to be 6,250 feet above the sea; while the lowest lake of suitable size in Yellowstone Park from which our collections were made was 1,200 feet higher than this. This topographical difference does not measure the biological difference, however, as the lower location is also more than five degrees south of the Yellowstone lakes.

Disregarding the doubtful *fluviatilis*, the species of *Epischura* are, so far as known, of north temperate range in North America. The form least modified, both in abdomen and fifth legs, is the Newfoundland species, *nordenskiœldii*, and the most modified in both is *nevadensis*, *lacustris* standing intermediate. The new form, again, is intermediate between *lacustris* and *nevadensis* proper and may be roughly characterized as uniting the characters of the fifth legs of the male and female and the caudal setæ of *nevadensis* with those of the abdomen of the male of *lacustris*.

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* Herrick's species hardly seems to belong to this genus. The abdominal processes are described as projecting from the left side of the abdomen, and consequently can not be homologized with those of *E. lacustris*, all of which are developed from the right, and the fifth foot of the male is scarcely capable of close comparison with the corresponding appendages of undoubted *Epischura*. The difference reported in the position of the hinge in the antennæ of the male also points to a deep-seated and fundamental distinction, not easy to reconcile, it must be admitted, with the agreement in *fluviatilis* and *lacustris* with respect to the inner ramus of the swimming legs, the fifth legs of the female, and the caudal setæ.

It differs from typical *nevadensis* in the more complete segmentation of the cephalothorax in both male and female, four sutures extending distinctly across the back. It is also a little larger, adult females measuring 2.12 to 2.4 millimeters in length to the tips of the rami, with an ordinary width across the cephalothorax of 6.4 millimeters. The male is somewhat smaller, about 2.1 millimeters in length.

The antennæ of the female are long and slender, reaching about to the posterior end of the penultimate segment of the abdomen. The first segment of the female abdomen is as long as the two following together, and the furca is as long as the preceding segment. The female abdomen is not curved as in *lacustris*, and the spermatophore extends downward and backward instead of curving upward, as in that species. The three caudal setæ are all similar and of equal width, the base of each being a third the width of the end of the furca. There is a short, stout, conical spine at the outer distal angle of each ramus, and a small, soft seta at the inner angle.

The fifth legs of the female are broader in proportion to their length than in *lacustris*, but more slender than in the *nevadensis* of Lilljeborg. The last segment of the leg is four times as long as broad and bears six teeth (occasionally seven), four of which are terminal. The inner of these four is commonly the largest, although the third from within may equal it. The inner lateral tooth is close to the inner terminal, and nearly or quite equals it in size, and the outer lateral is nearly opposite. Sometimes there are two teeth on the outer margin of this segment. The middle joint of this leg is less than half as wide as long, and the basal is longer than wide.

In the male abdomen there are five distinguishable segments, as in all the other species,* the second, third, and fifth bearing lateral processes extending to the right. The first three segments are subequal in length. The lateral process of the second has the form of a stout but thin wing or lamina projecting laterally a distance equal to the width of the segment. It springs from a broad and thick prominence of the segment itself; is acute at the apex, with the point a little recurved, convex and smooth in front, as seen from above, and nearly straight behind, except that this edge is irregularly and minutely serrate throughout and deeply emarginate where it joins the segment. As seen from the side this blade is strongly curved downward (ventrally), like the following. The third segment bears a broad, thin lamina which projects outward and a little backward from its posterior angle as a flat process, as wide as long, curved downward and broadly rounded at the end, quite simple, except that it is strengthened beneath by a ridge of chitin. These processes are in strong contrast to the corresponding ones of *nevadensis* proper. From the fourth segment spring two processes, the ventral of which is very similar to that of *nevadensis*, but broader, a triangle in form, with nearly equal sides, with the apex slightly truncate and bearing three serrations, and with the posterior side very minutely roughened. The dorsal process of this segment is a small irregular plate curving forward, inward, and downward.

Fifth pair of legs substantially as in *nevadensis* Lillj.

Abundant in Swan and Flathead lakes, Montana.

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*A recent study of the male abdomen in *lacustris* shows beyond a doubt that the fourth and fifth segments are flexibly articulated and that the fourth is without process, the fifth bearing two processes, as in all the other species.

ROTIFERA.

Monostyla ovata, n. sp.

Lorica broad ovate, truncate, antennæ nearly as broad before as behind. Dorsal outline regularly rounded, not recurved before. Lobe flat; ventral plate flat. Toe with very distinct shoulder, however viewed. Front margins of both dorsal and ventral plates entire. Dorsal plate strengthened by two diverging longitudinal ribs, about equidistant from each other and from the lateral angles of the plate, rendering the anterior margin slightly angulate where they join it and vanishing behind at about the middle of the shell. Eye single, transverse, oval, red, situated just above and before the mastax, with two very minute red points behind it. Foot and toe about two-thirds as long as the lorica is wide. Ventral plate much shorter posteriorly than dorsal, its posterior margin slightly excavated before the foot.

Dimensions, 0.25 millimeter long by 0.18 millimeter wide.

From warm spring (103° F.), Yellowstone Lake, August 3, 1890.

Conochilus leptopus, n. sp.

Resembling *C. volvox*. Antennæ adnate to the tip, where the pair are rounded off as one; but very slightly bifid at the base of the two hairs. Stalk not swollen, slender, tapering backward regularly from the slightly dilated point of attachment to the body. Eyes black, about midway between cloacal opening and edge of disk. Cloaca about half of distance from the edge of the disk to the base of the expanded body. Trophi slightly tinted yellowish brown, not orange.

Entire length, when expanded, 0.32 millimeter; extended stem, 0.13 millimeter; breadth of body, 0.088 millimeter; expanded disk, 0.094 millimeter.

Exceedingly abundant in spherical colonies in Yellowstone Lake, July and August, 1890, and also in Lewis Lake, Yellowstone Park, July, 1890.

PROTOZOA.

Stentor igneus, var. fuliginosus.

Form turbinate, with slightly swollen sides, very slightly changeable, peristome with spiral lobe, greatest width slightly more than half greatest length. Color soot-black, given by blackish granules; when decolorized showing green as if by chlorophyl.

Individuals when highly magnified gray by reflected or transmitted light, through mingling of green and black.

Form not symmetrical, the right side (when spiral lobe of peristome is uppermost) being swollen below. When the peristomal lobe is at the side it appears as a tubercle or projection. Form sometimes considerably shortened, so as not to be longer than broad. Peristome angularly produced, so as to form with tip of spiral lobe an equiateral triangle, giving the entire animal an angular or trigonal shape. Tip flexible and contractile, transparent when extended.

Swarmed in Lake of the Woods August 20, 1890, forming soot-like collections as a film on the surface among pond lilies (*Nelumbium*) and a discontinuous coating on under sides of the same.

EXPLANATION OF PLATES.

PLATE XXXVII.

Fig. 1. ***Daphnia pulex*****, var.** ***pulicaria*****. Male.**
Fig. 2. ***Daphnia dentifera*****.**
Figs. 3, 4. ***Cypris barbatus*****.**

PLATE XXXVIII.

Figs. 5–8. ***Cypris barbatus*****. (5) First antenna. (6) Second antenna. (7) Postabdomen. (8) Mandible.**

PLATE XXXIX.

Figs. 9–12. ***Cyclops thomasi*****. (9) First leg. (10) Second leg. (11) Third leg. (12) Fourth leg.**

PLATE XL.

Fig. 13. ***Cyclops thomasi*****, fifth leg.**
Figs. 14–17. ***Cyclops capilliferus*****. (14) Adult female. (15) First leg. (16) Fourth leg. (17) Fifth leg.**

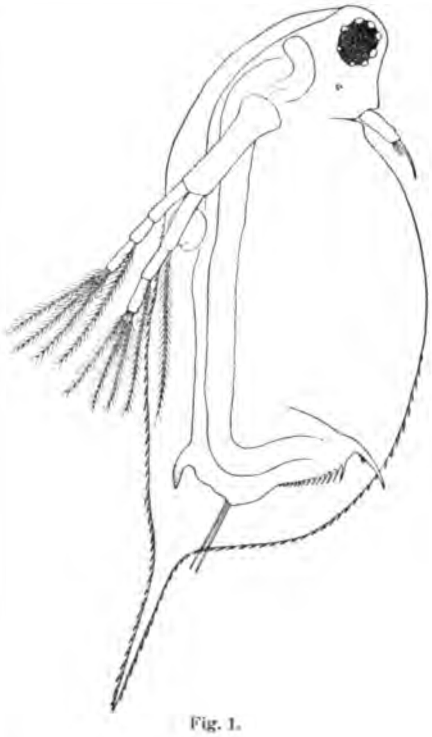
PLATE XLI.

Fig. 18. ***Cyclops capilliferus*****, antenna of female.**
Figs. 19–21. ***Epischura nevadensis*****, var.** ***columbiæ*****. (19) Abdomen of male. (20) Fifth pair of legs of male. (21) Fifth pair of legs of female.**
Fig. 22. ***Diaptomus piscinæ*****, fifth pair of legs of male.**

PLATE XLII.

Figs. 23–25. ***Diaptomus shoshone*****. (23) Fifth pair of legs of male. (24) Fifth leg of female. (25) Right antenna of male.**
Figs. 26–28. ***Diaptomus lintoni*****. (26) Fifth leg of female. (27) Fifth pair of legs of male. (28) Terminal segments of antenna.**

Bull. U S F. C. 1891. Aquatic Invertebrate Fauna of Wyoming and Montana. (To face page 258) **PLATE XXXVII.**



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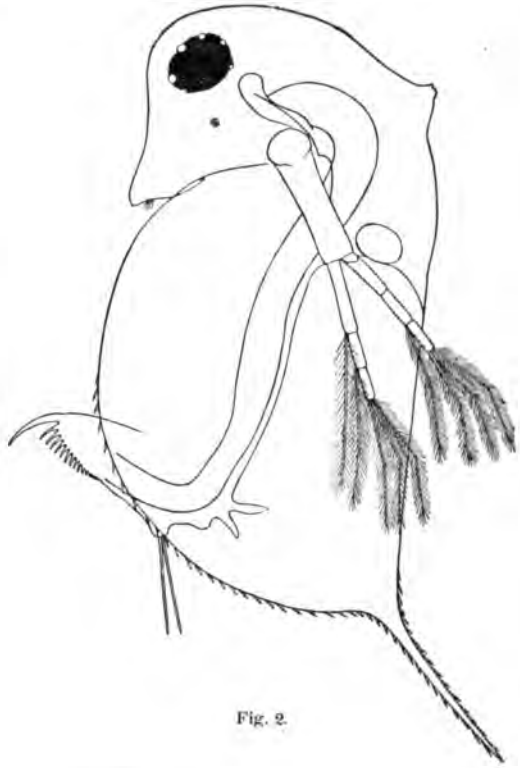

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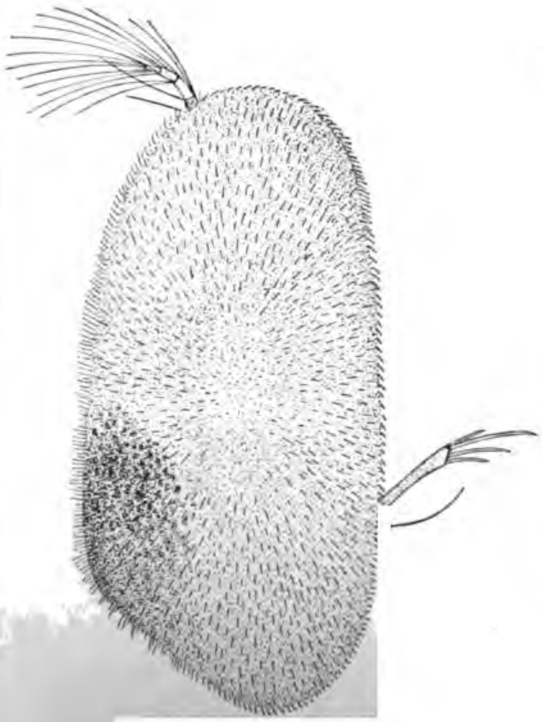

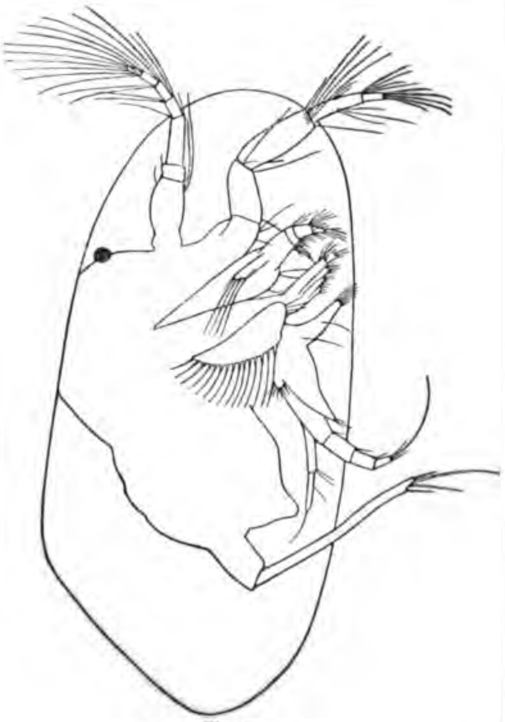

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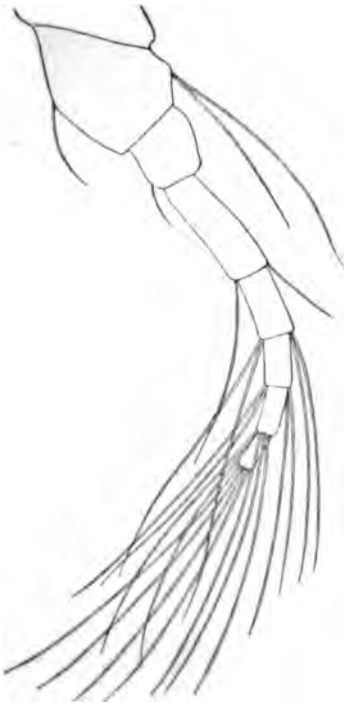

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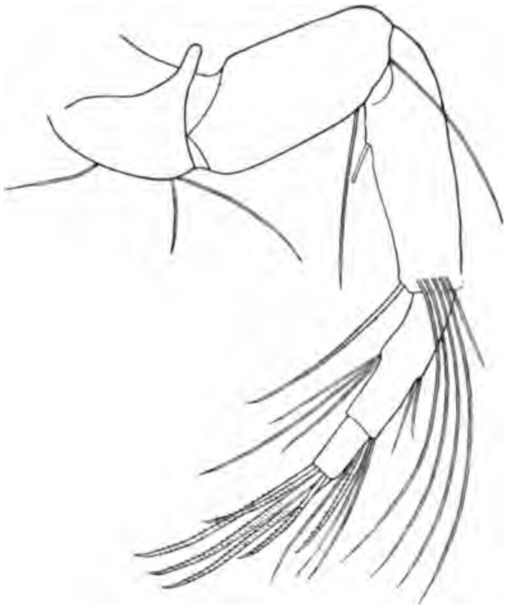

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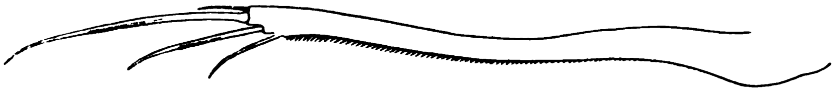

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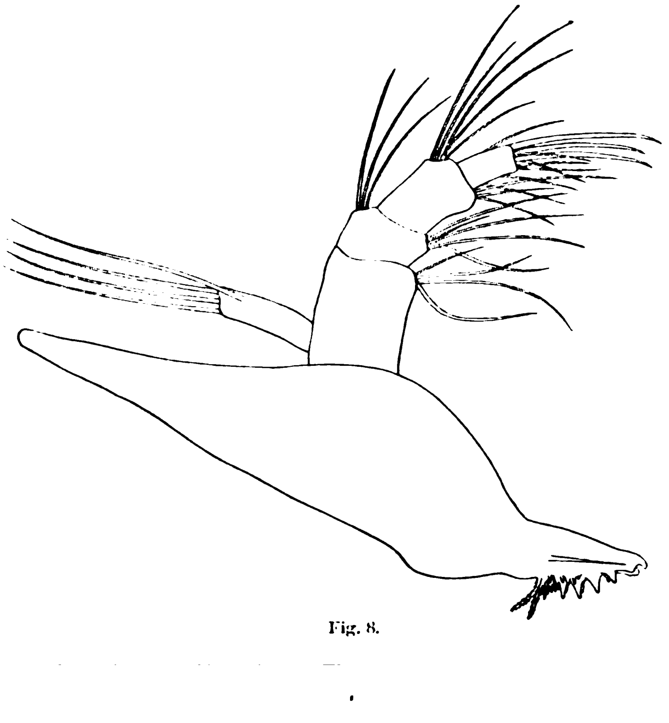

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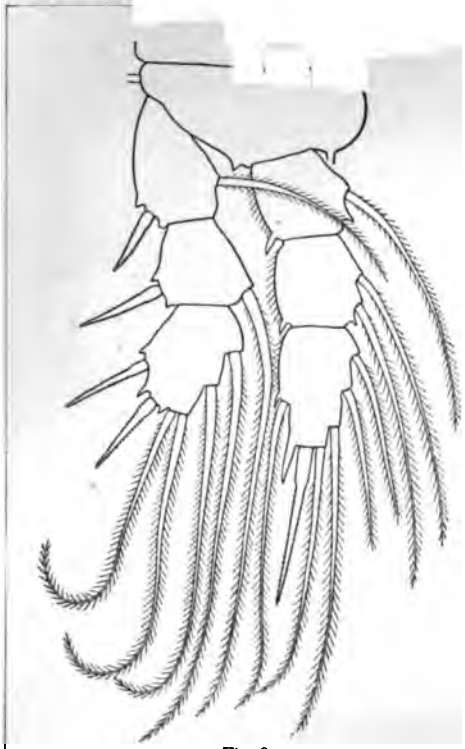

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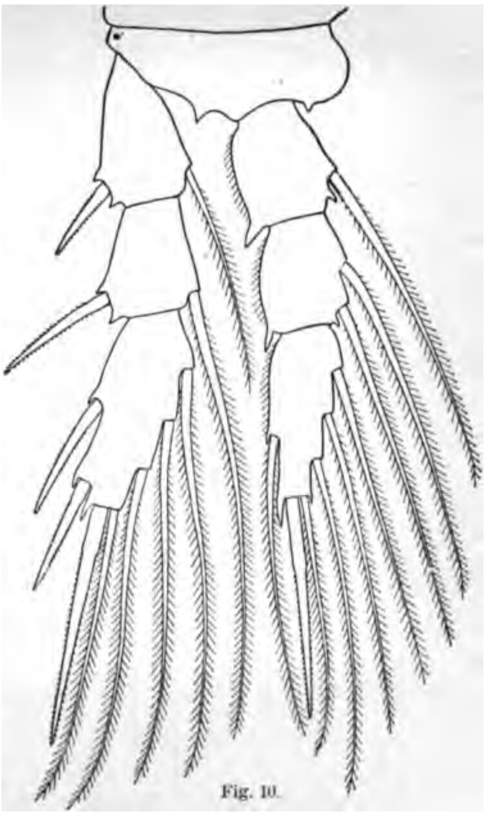

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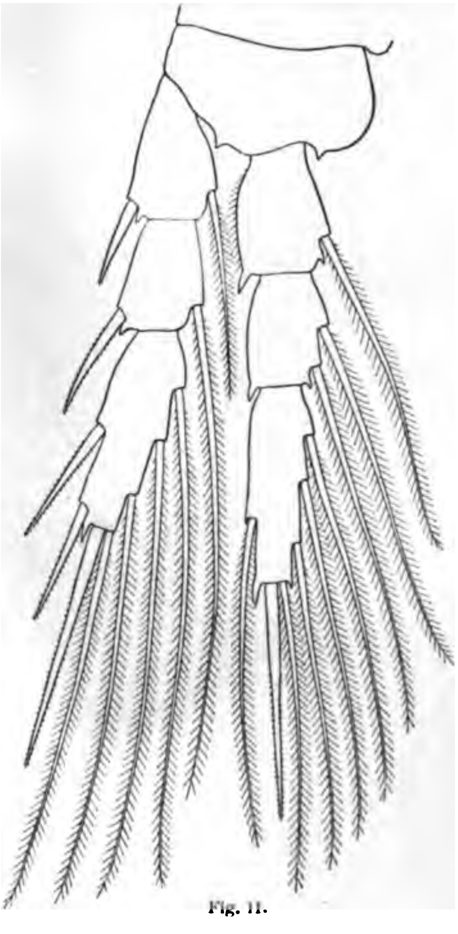

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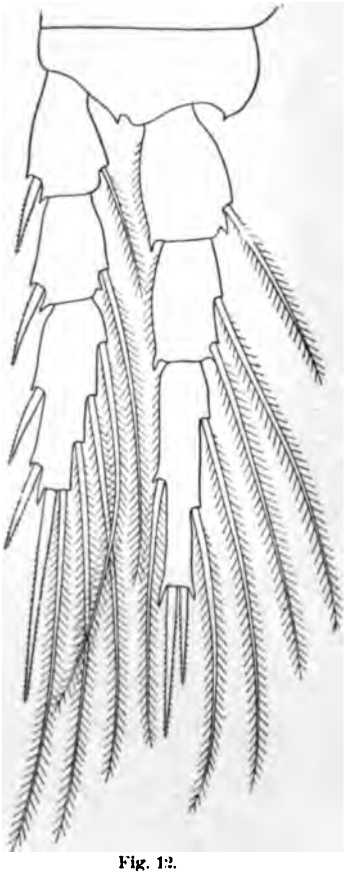

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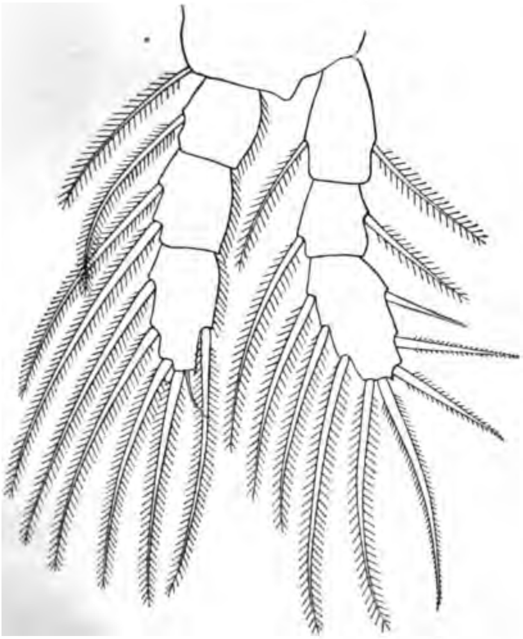

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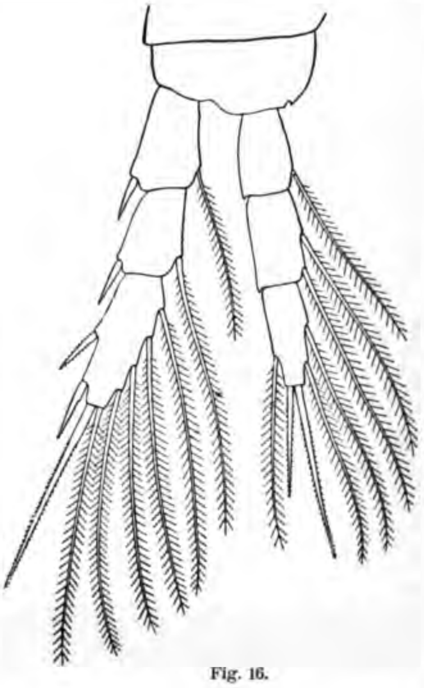

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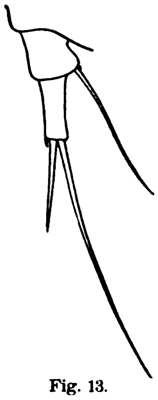

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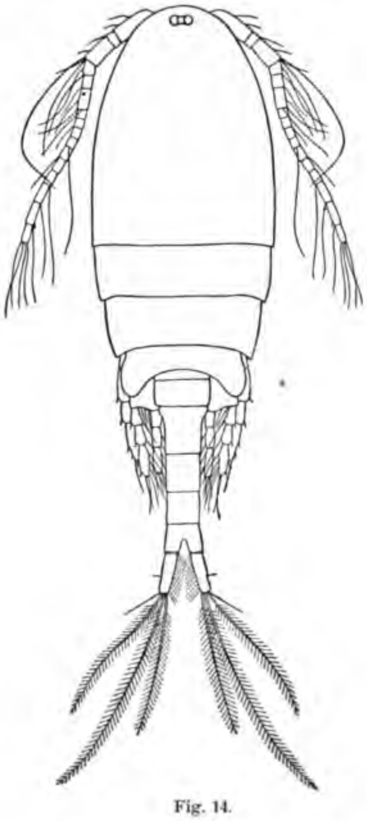

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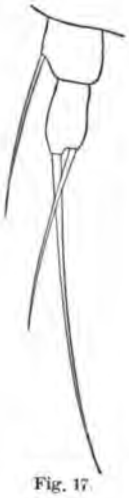

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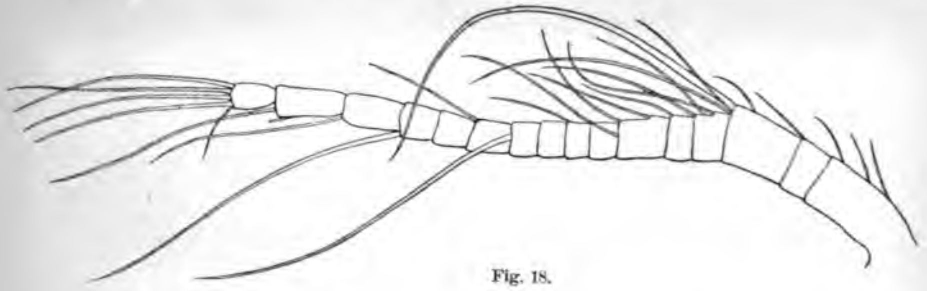

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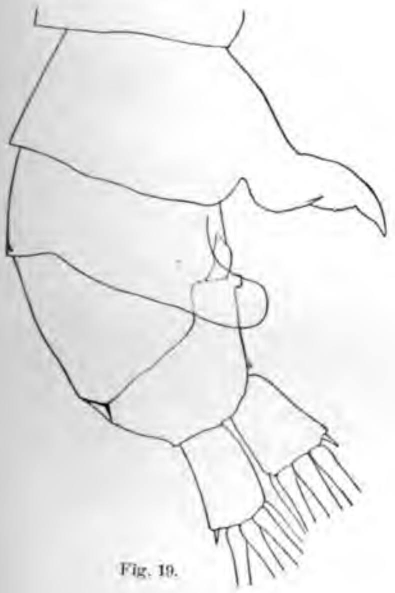

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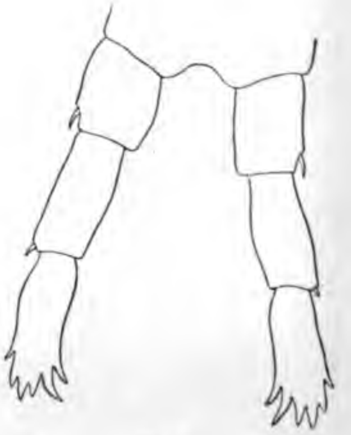

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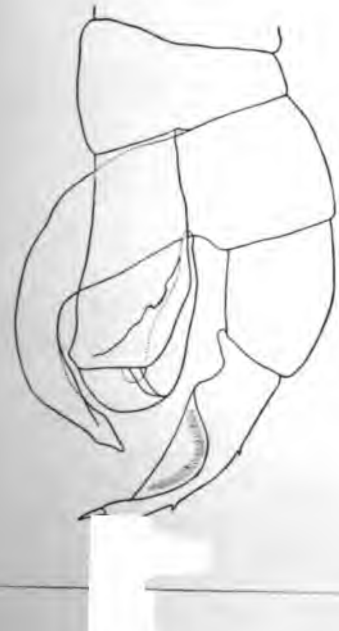


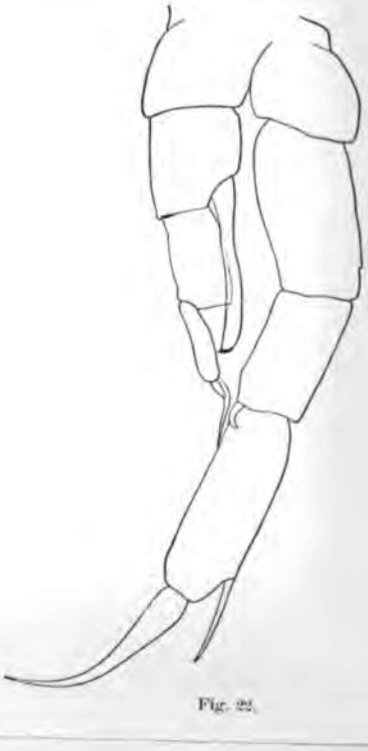


Fig. 22.

PLATE XLII.

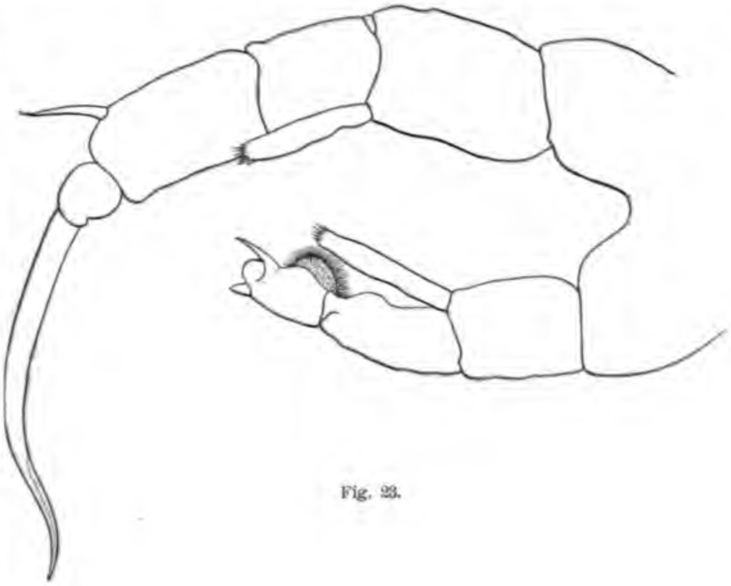


Fig. 23.

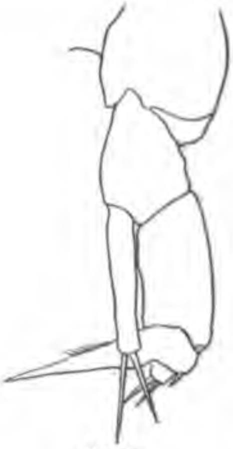
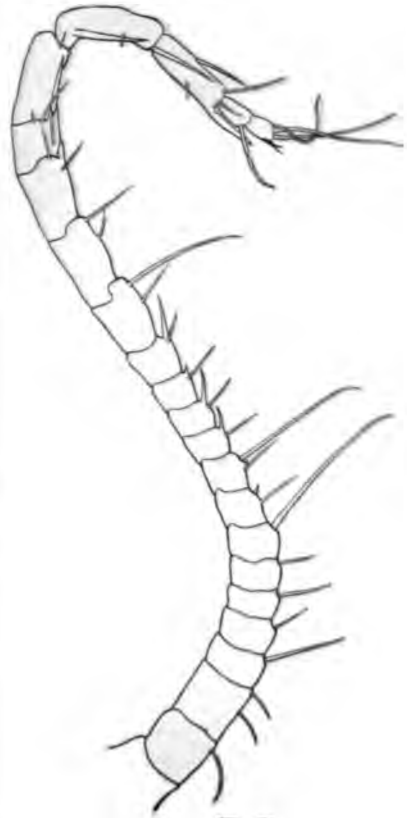


Fig. 24.



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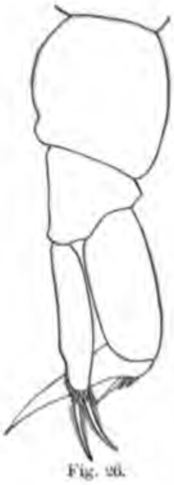

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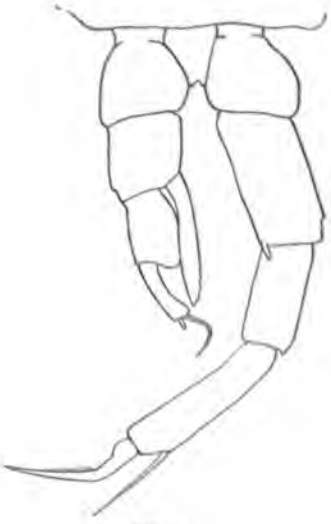

Fig. 27.

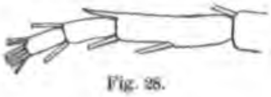

Fig. 28.

7.—NOTES ON A COLLECTION OF FISHES FROM THE SOUTHERN TRIBUTARIES OF THE CUMBERLAND RIVER IN KENTUCKY AND TENNESSEE.

BY PHILIP H. KIRSCH,

State Fish Commissioner of Indiana.

All of the specimens noted in the present paper were collected by the writer in the southern tributaries of the Cumberland River between Nashville, Tenn., and the Cincinnati Southern Railroad, during the period from August 18 to September 9, 1891.

The streams examined may be grouped as follows:

Stone River:
  1. West Fork Stone River near Murfreesboro, Tenn.

Spring Creek:
  1. Spring Creek, Spring Creek Station, Tenn.

Round Lick:
  1. Round Lick, Watertown, Tenn.

Caney Fork River:
  1. Caney Fork near Lancaster, Tenn.
  2. Smith Fork near Lancaster, Tenn.

Roaring River:
  1. Roaring River near Windle, Tenn.
  2. Spring Creek at Netherland, Tenn.

Obeys River:
  1. Obeys River at Olympus, Tenn.
  2. Eagle Creek near Olympus, Tenn.
  3. Wolf River near Byrdstown, Tenn.

Cumberland River:
  1. Cumberland River, Cumberland County, Ky.
  2. Willis Creek, Cumberland County, Ky.

Beaver Creek:
  1. Beaver Creek, Wayne County, Ky.
  2. Otter Creek, Wayne County, Ky.

Big South Fork of the Cumberland River:
  1. Little South Fork, Whitley County, Ky.
  2. Canada Creek, Whitley County, Ky.
  3. Big South Fork, near Whitley Station, Ky.
  4. Rock Creek, near Whitley Station, Ky.
  5. New River at New River Station, Tenn.
  6. Brimstone Creek near New River Station, Tenn.

STONE RIVER.

Stone River is formed in Rutherford County, Tennessee, by the confluence of the East and West Forks; it takes a northwesterly course through Davidson County and flows into the Cumberland River about 12 miles above Nashville.

The *West Fork*, near Murfreesboro, Tenn., August 20: This stream was seined for a distance of 1 mile below Murfreesboro. The river at this point has a width of 175 to 200 feet; the banks are generally low; the bottom of the channel is mostly of cherty limestone.

FISHES OF THE WEST FORK OF STONE RIVER.

1. **Catostomus nigricans** Le Sueur. Abundant in deep, swift waters.
2. **Moxostoma macrolepidotum duquesnei** (Le Sueur). Everywhere common. Agrees with the description given by Dr. D. S. Jordan, Manual of Vertebrates, edition 1888.
3. **Lagochila lacera** Jordan & Brayton. The single specimen taken is 6 inches in length.
4. **Campostoma anomalum** (Rafinesque). *Little brown sucker.* Abundant in swift waters.
5. **Pimephales notatus** (Rafinesque). The largest of the 22 specimens, 3¼ inches long. Black spot on front of dorsal fin indistinct.
6. **Notropis boops** Gilbert. Very scarce.
7. **Notropis whipplei** (Girard). Very abundant. Length of head equals depth of body.
8. **Notropis galacturus** (Cope). Common everywhere.
9. **Notropis megalops** (Rafinesque). Specimens small and varied in form and color.
10. **Notropis telescopus** (Cope). Not common.
11. **Hybopsis amblops** (Rafinesque). Scarce.
12. **Hybopsis kentuckiensis** (Rafinesque). Equally scarce with the preceding.
13. **Zygonectes notatus** (Rafinesque). Rather common. Largest taken, 2 inches long.
14. **Labidesthes sicculus** (Cope). Very common.
15. **Lepomis pallidus** (Mitchill). The largest of the 5 specimens, 4½ inches.
16. **Lepomis megalotis** (Rafinesque). Not common.
17. **Micropterus dolomieu** Lacépède. *Trout.*
18. **Etheostoma simoterum atripinnis** (Jordan). The single specimen taken is 2¼ inches in length, and highly colored.
19. **Etheostoma blennioides** Rafinesque. Abundant. D. XIII or XIV—13.
20. **Etheostoma caprodes** (Rafinesque).
21. **Etheostoma rufolineatum** (Cope). The larger of the two specimens 1½ inches long.
22. **Etheostoma squamiceps** Jordan. Seven specimens taken, varying in length from 1 to 3½ inches. Comparing these specimens with the description of *E. squamiceps* in Jordan & Gilbert's Synopsis of Fishes of North America and with that in Jordan's Manual of Vertebrates, 5th edition, the following differences are notable: The lower fins of the males are not black but they are pale in either sex. Males have 7 or 8 crossbars on the dorsal region instead of 6. There are more than 50 scales in the lateral line; in all the specimens examined the number varied from 53 to 57. The gill-membranes are not broadly united across the isthmus, but on the contrary they are scarcely united at all.

SPRING CREEK.

Spring Creek has its source in the southeast part of Wilson County, Tennessee, from which region it flows 32 miles in a northwesterly direction, where it empties into the Cumberland River about 25 miles above Nashville. It was investigated at Spring Creek Station, 12 miles from its mouth, August 21. Here the stream has a width of 30 feet. Its banks are low and sloping, with no exposure of rock. There are long stretches of deep, quiet water. On account of the mud, wood, and brush covering the bottom, it is hard to work it satisfactorily. During a long drought the stream becomes almost dry on the shoals.

FISHES OF SPRING CREEK.

1. **Ameiurus natalis** (Le Sueur). Scarce. Largest taken, 7 inches.
2. **Catostomus nigricans** Le Sueur. Common in swift currents.
3. **Moxostoma macrolepidotum duquesnei** (Le Sueur). A common food-fish among local fishermen.
4. **Campostoma anomalum** (Rafinesque). *Little black sucker.* Common in all pools below shoals.
5. **Pimephales notatus** (Rafinesque). Very numerous.
6. **Notropis whipplei** (Girard). Not common.

7. **Notropis galacturus** (Cope). Scarce.
8. **Notropis megalops** (Rafinesque). *Silverside.* Common, as usual in southern streams.
9. **Notropis umbratilis cyanocephalus** (Copeland). Everywhere common.
10. **Notropis atherinoides** Rafinesque.
11. **Hybopsis amblops** (Rafinesque). Four small specimens only were taken.
12. **Hybopsis kentuckiensis** (Rafinesque.) Two small specimens.
13. **Fundulus catenatus** (Storer.) Scarce. Fish highly colored.
14. **Zygonectes notatus** (Rafinesque). One specimen.
15. **Labidesthes sicculus** (Cope). Scarce.
16. **Lepomis pallidus** (Mitchill). Scarce. No black spot on anal.
17. **Lepomis megalotis** (Rafinesque). Abundant.
18. **Micropterus salmoides** (Lacépède). *Trout.*
19. **Etheostoma simoterum atripinnis** (Jordan). Common.
20. **Etheostoma blennioides** Rafinesque. Common in clear water.
21. **Etheostoma caprodes** (Rafinesque). Equally common.
22. **Etheostoma rufolineatum** (Cope). Six specimens were taken, the largest 2 inches long.
23. **Etheostoma squamiceps** Jordan. One specimen.

ROUND LICK CREEK.

Round Lick Creek is a small stream in Wilson County, Tennessee; it has a northerly course and is tributary to the Cumberland River. It was fished at Watertown, August 22. The channel has a width of 25 feet; its bottom is of smooth limestone and free from loose rocks and rubbish. The bottom land is broad and fertile.

FISHES OF ROUND LICK CREEK.

1. **Ameiurus natalis** (Le Sueur). A few small specimens.
2. **Campostoma anomalum** (Rafinesque). Abundant, color dark.
3. **Pimephales notatus** (Rafinesque).
4. **Notropis megalops** (Rafinesque). Common.
5. **Notropis ariommus** (Cope). A single specimen.
6. **Notropis umbratilis cyanocephalus** (Copeland). Everywhere common.
7. **Notropis atherinoides** (Rafinesque). Scarce.
8. **Semotilus atromaculatus** (Mitchill). Common.
9. **Fundulus catenatus** (Storer). Common.
10. **Lepomis megalotis** (Rafinesque). Common and of large size.
11. **Etheostoma simoterum atripinnis** (Jordan). Exceedingly abundant; more than 1,000 specimens were secured in a distance of three-fourths of a mile.
12. **Etheostoma squamiceps** Jordan. Thirty specimens were secured from smooth limestone bottom. Characteristics similar to those from Spring Creek and Stone River.
13. **Cottus bairdi** Girard. A few small specimens from rocky bottom among grass.

CANEY FORK RIVER.

Caney Fork River is formed by the confluence of several small streams in Warren County, Tenn., and after a northerly course through De Kalb and Smith counties it flows into the Cumberland River opposite Carthage. Collections were made at the following points:

1. *Caney Fork River*, near Lancaster: This stream was investigated 1 mile west of Lancaster, August 24. The channel has an average width of 175 feet. On account of recent rains the water was up and but little seining could be done. The bottom land is narrow, and the bordering bluffs steep, rising in places to a height of 250 feet.

The margin of the stream is fringed with a thick growth of willows. Species from this stream are marked "C."

2. *Smith Fork*, Lancaster: Smith Fork has its source in the southern part of Wilson County, Tenn.; it takes a northwesterly course and joins Caney Fork River near Lancaster. August 24 the work in this stream was done for a distance of 1 mile above the railroad bridge. The channel is cut into solid limestone, and in many places is covered with fragments of rocks which have fallen from the steep side hills. Smith Fork is a beautiful stream and abundantly stocked with native fish. Specimens collected from this stream are marked "S."

At this point I was materially assisted by Messrs. W. H. Nixon, A. Jackson, T. J. Lancaster, and C. C. Smith.

FISHES OF CANEY FORK RIVER.

1. **Lepisosteus osseus** (Linnæus). (S.)
2. **Ictalurus punctatus** (Rafinesque). (S.)
3. **Ameiurus nigricans** (Le Sueur). (S.) Common.
4. **Leptops olivaris** (Rafinesque. (S.) Three specimens were secured, the largest 10 inches long.
5. **Noturus flavus** Rafinesque. (S.) A single small specimen.
6. **Ictiobus difformis** (Cope). *High-backed sucker.* (C, S.) A common food-fish.
7. **Catostomus nigricans** Le Sueur. (C, S.) Common in currents in the latter stream.
8. **Moxostoma macrolepidotum duquesnei** (Le Sueur). *White sucker.* (C, S.) Equally common in both streams.
9. **Campostoma anomalum** (Rafinesque). (S.)
10. **Hybognathus nuchalis** Agassiz. (S.) A single specimen.
11. **Pimephales notatus** (Rafinesque). (S.) The single fish taken is 2¼ inches long.
12. **Notropis whipplei** (Girard). (C, S.) Very common.
13. **Notropis galacturus** (Cope). (S.) One.
14. **Notropis megalops** (Rafinesque). (S.) Scarce.
15. **Notropis atherinoides** Rafinesque. (S.) Common and of large size.
16. **Hybopsis watauga** Jordan & Evermann. (C, S.) Not common. Head, 4 in length of body; eye equals length of snout and 3 in length of head.
17. **Hybopsis amblops** (Rafinesque). (S.) Scarce.
18. **Hybopsis storerianus** (Kirtland). (S.) The largest 6 inches long.
19. **Ambloplites rupestris** (Rafinesque). (S.)
20. **Lepomis megalotis** (Rafinesque). (S.) Scarce.
21. **Micropterus dolomieu** Lacépède. *Trout.* (S.)
22. **Etheostoma simoterum atripinnis** (Jordan). (S.)
23. **Etheostoma blennioides** Rafinesque. (S.)
24. **Etheostoma caprodes** (Rafinesque). (S.) Common.
25. **Etheostoma aspro** (Cope & Jordan). (S.) Two small specimens.
26. **Etheostoma evides** (Jordan & Copeland). (C, S.) Scarce.
27. **Etheostoma rufolineatum** (Cope). Scarce.
28. **Etheostoma stigmæum** (Jordan). (S.) Very abundant.
29. **Stizostedion vitreum** (Mitchill). (S.) *Spotted trout.*
30. **Aplodinotus grunniens** Rafinesque. *White perch.* (S.) Common.

ROARING RIVER.

Roaring River is formed in the southern part of Overton County, Tenn.; it flows north through Jackson County and pours its waters into the Cumberland River near Gainesborough. Fish were collected at the following places:

1. *Roaring River*, near Windle: This stream was fished August 30, a few miles from Windle. The current is deep, the channel has a width of about 30 feet, and its bottom is covered with wood and rocks. Fish from this stream are marked "R."

2. *Spring Creek:* This stream heads in Putnam County, Tenn. After a northerly course through Overton and Jackson counties it empties into the Roaring River. Spring Creek was investigated at Netherland, Overton County, Tenn., August 25. The channel here is 30 feet wide; its bottom is of limestone, frequently covered with loose rocks. The shoals are very rough and rocky. Specimens are marked "Sp."

FISHES OF ROARING RIVER.

1. **Catostomus nigricans** Le Sueur. (R.) Common.
2. **Catostomus teres** (Mitchill). (Sp.) Common and of large size.
3. **Campostoma anomalum** (Rafinesque). (R.) Common.
4. **Chrosomus erythrogaster** Rafinesque. (R, Sp.) Scarce.
5. **Notropis galacturus** (Cope). (R.) Common.
6. **Notropis umbratilis cyanocephalus** (Copeland). Common.
7. **Rhinichthys atronasus** (Mitchill). (R.) Very common.
8. **Hybopsis kentuckiensis** (Rafinesque). (R.) The most abundant species in the river.
9. **Semotilus atromaculatus** (Mitchill). (R, Sp.) Especially common in Spring Creek.
10. **Ambloplites rupestris** (Rafinesque). (R, Sp.)
11. **Micropterus dolomieu** Lacépède. (R.)
12. **Etheostoma blennioides** Rafinesque. (R.) Two small specimens.
13. **Etheostoma cœruleum** Storer. (R.) Two small specimens.
14. **Cottus bairdi** Girard. (R, Sp.) Not common. The specimens from Spring Creek had their stomachs filled with water insects.

OBEYS RIVER.

The Obeys River is formed near Byrdstown, Tenn., by the junction of the East and West Forks. It has a general northwest course through Pickett and Clay counties and flows into the Cumberland River at Celina. The Obeys River basin was examined at the following three points:

1. *Obeys River*, Olympus, August 28: This stream was seined for a distance of one mile and a half. Here the river has a width of 180 feet, a solid limestone bottom with occasional outcrops of shale, and many gravelly shoals. Fish very abundant. The specimens from Obeys River are marked "O."

2. *Eagle Creek* heads in Overton County, Tenn., and after a general northwesterly course it empties into Obeys River at Olympus, in Pickett County. August 27 this creek was fished for a distance of 2 miles in its lower course. The banks are low, and the bottom of the channel is of limestone or shale with many gravelly shoals. This is a beautiful stream with an abundance of fish. The collections are marked "E."

3. *Wolf River*, near Byrdstown: This river rises in Fentress County, Tenn. It has a northwest course and is tributary to the Obeys River at the Mouth of Wolf post-office. August 28 this stream was investigated at a point 3 miles north of Byrdstown. Here the channel has a limestone bottom with a few shoals. Fish from this stream marked "Wf."

FISHES OF OBEYS RIVER.

1. **Lepisosteus osseus** (Linnæus). (O.) Common.
2. **Ictalurus punctatus** Rafinesque. (O.) A single specimen from deep water.
3. **Ameiurus nebulosus** (Le Sueur). (O.) Scarce; color dark.
4. **Noturus flavus** Rafinesque. (O. E.) A single fish from each stream.
5. **Catostomus nigricans** Le Sueur. (O, E, Wf.) The largest taken from Eagle Creek, 14 inches long.
6. **Moxostoma macrolepidotum duquesnei** (Le Sueur). (O, E, Wf.) Common in all the streams.
7. **Campostoma anomalum** (Rafinesque). (E, Wf.)
8. **Pimephales notatus** (Rafinesque). (Wf.) Abundant.
9. **Notropis boops** Gilbert. (Wf.) Scarce.
10. **Notropis whipplei** (Girard). (O, E, Wf.) Scarce.
11. **Notropis galacturus** (Cope). (O, E, Wf.) Very common except in Obeys River.
12. **Notropis megalops** (Rafinesque). (O, E, Wf.) Common everywhere.
13. **Notropis ariommus** (Cope). (E.) A single specimen.
14. **Notropis umbratilis cyanocephalus** (Copeland). (E. Wf.) Not common.
15. **Notropis telescopus** (Cope). (O, E.) Very common in Obeys River.
16. **Notropis atherinoides** Rafinesque. (O, E, Wf.) Common everywhere.
17. **Phenacobius uranops** Cope. (O, E, Wf.) Common. The largest from Obeys River, 3½ inches long. D. 8; A. 7.
18. **Hybopsis watauga** Jordan & Evermann. (O, E.) Numerous specimens from 2 to 4 inches long. The larger without dusky spots on the lateral band.
19. **Hybopsis amblops** (Rafinesque). (E, Wf.)
20. **Hybopsis kentuckiensis** (Rafinesque). (E, Wf.) Common and of large size.
21. **Clupea chrysochloris** (Rafinesque). (O.) Several specimens; all small.
22. **Fundulus catenatus** (Storer). (O, E, Wf.) Common.
23. **Labidesthes sicculus** (Cope). (O.) Live specimens.
24. **Ambloplites rupestris** (Rafinesque). (O, Wf.) Common in Obeys River; a single specimen from Wolf River.
25. **Lepomis megalotis** (Rafinesque). (O, E, Wf.) Abundant in Obeys River.
26. **Micropterus dolomieu** Lacépède. (O, E, Wf.)
27. **Etheostoma simoterum atripinnis** (Jordan). (E.)
28. **Etheostoma blennioides** Rafinesque. (O, E, Wf.)
29. **Etheostoma caprodes** (Rafinesque). (O, E, Wf.)
30. **Etheostoma macrocephalum** Cope. (O, E.)
31. **Etheostoma evides** (Jordan & Copeland). (O.)
32. **Etheostoma rufolineatum** (Cope). (E.) One small specimen.
33. **Etheostoma cinereum** Storer. (O, E, Wf.) Especially common in Wolf River. Largest specimen taken about 3½ inches long. Head about 3½ in length of body; depth 5½. D. XI to XII-11 to 13; A. II, 8. Lateral line 57 to 60.

   Body oblong, somewhat compressed. Head pointed, gibbous over the eyes. Diameter of eye greater than length of snout and 4 in length of head. Interorbital space narrow. Mouth horizontal; upper jaw projecting; premaxillary not protractile; maxillary not reaching front of eye; teeth on vomer, and several irregular rows of teeth on the jaws. Opercles and preopercles covered with scales; breast and space in front of first dorsal naked. A small spine extends backward from near the free edge of the opercle. Gill membranes are united but not connected with the isthmus. The front of second dorsal is midway between the center of pupil and the base of caudal fin; the space between the two dorsals about equal to the diameter of the eye; the base of the first and second dorsals equal in length. Free edge of first dorsal rounded, its longest spine 1½ in base of fin, second dorsal high, its free edge straightish, longest ray equal in length to base of fin. Base of anal fin shorter than that of second dorsal and placed opposite the middle of that fin; first anal spine the shorter. Caudal fin somewhat shorter than the base of first dorsal. Pectorals extend to the posterior insertion of first dorsal. Ventrals about equal in length to base of second dorsal.

   Scales ctenoid. Lateral line complete, slightly decurved.

Coloration: The upper portion of the body is of a light yellow; the dorsal region is marked with four dark cross-bars; the first and largest of these is between the two dorsals, the next two in the base of the second dorsal, and the last upon the caudal peduncle. On the sides above the lateral line each scale is marked with a brown spot. These spots form 2 or 3 series of lines running backward to the region of the second dorsal. The lower portions of the body are yellowish-white. Following the course of the lateral line is a series of 11 or 12 oblong spots which are continuous downward and backward as a faint bar. On either side of the head the spots on the lateral line are replaced by dark bands which pass forward through the eyes and meet on the tip of the snout. "First dorsal is margined with red; second dorsal and anal variegated with red spots."

34. **Etheostoma obeyense** Kirsch. (O.) Two small specimens only were secured.
35. **Etheostoma cœruleum** Storer. (O, E, Wf.) Common in Eagle Creek; Obeys and Wolf rivers one each.
36. **Etheostoma zonale** (Cope). One specimen from Obeys River.
37. **Etheostoma copelandi** (Jordan). One specimen from Obeys River.
38. **Etheostoma stigmæum** (Jordan). Abundant in all these streams.
39. **Cottus bairdi** Girard. (O.) Not many were taken.

CUMBERLAND RIVER.

1. During these explorations the main stream of the Cumberland River was touched only at the "lock and dam" near the mouth of Willis Creek, Cumberland Co., Ky. Here the river is easily worked but with the short seine only at command not much could be done. Fish from this stream are marked "C."

2. *Willis Creek* is in Clinton County, Ky. It flows in a northwesterly direction and empties into the Cumberland River in Cumberland County. September 1 this little creek was fished at its mouth. Specimens from here are marked "W."

For the prosecution of the work at this point I am greatly indebted to Capt. Wash Hurt for valuable assistance.

FISHES OF THE CUMBERLAND RIVER.

1. **Lepisosteus osseus** (Linnæus). (C.) Many were taken.
2. **Ictiobus difformis** (Cope). (W.) One.
3. **Catostomus nigricans** Le Sueur. (W.)
4. **Moxostoma macrolepidotum duquesnei** (Le Sueur). (C, W.) Very common.
5. **Campostoma anomalum** (Rafinesque). (W.) Common.
6. **Notropis whipplei** (Girard). (W.) Scarce.
7. **Notropis galacturus** (Cope). (W.) Specimens all small; color dark.
8. **Notropis megalops** (Rafinesque). (W.) Scarce.
9. **Notropis umbratilis cyanocephalus** (Copeland). (C, W.)
10. **Notropis telescopus** (Cope). (W.) A single small specimen.
11. **Notropis atherinoides** Rafinesque. (C.) One only.
12. **Phenacobius uranops** Cope. (W.) One.
13. **Rhinichthys atronasus** (Mitchill). A single specimen.
14. **Clupea chrysochloris** (Rafinesque). (C.) Numerous small specimens were secured.
15. **Fundulus catenatus** (Storer). (W.)
16. **Micropterus salmoides** (Lacépède). (C, W.)
17. **Micropterus dolomieu** Lacépède.
18. **Etheostoma caprodes** (Rafinesque). (W.) Scarce.
19. **Etheostoma aspro** (Cope & Jordan). (C.)
20. **Etheostoma cœruleum** Storer. (W.) Very common.
21. **Etheostoma stigmæum** (Jordan). (W.) Common.
22. **Aplodinotus grunniens** Rafinesque. *White perch.* (C.) The largest of the many specimens taken is 8 inches long.

BEAVER CREEK.

Beaver Creek drains the western portion of Wayne County, Ky. It has a general northwest course and empties into the Cumberland River 3 miles above Rowena. Beaver Creek system was examined at the following points:

1. *Beaver Creek*, Wayne County, Ky., September 3. The work on this stream was done both above and below McCackney's milldam. The channel is very rocky. Specimens from this creek are marked "B."

2. *Otter Creek.*—This stream rises among the mountains in the extreme southwest part of Wayne County, Ky. It takes a northerly course and empties into Beaver Creek a few miles from its mouth. September 2 this stream was seined at a point near Jones's milldam, on the Monticello and Albany road. Like Beaver Creek it is a narrow, tortuous, rocky mountain stream and exceedingly hard to work. Fish noted from this stream are marked "O."

FISHES OF BEAVER CREEK.

1. **Ameiurus nebulosus** (Le Sueur.) (B, O.) Those from Beaver Creek were taken in a muddy side-channel which has no connection with the main stream during low water.
2. **Catostomus nigricans** Le Sueur. (B, O.) Common in all swift waters.
3. **Moxostoma macrolepidotum duquesnei** (Le Sueur). (B, O.) Regarded as one of the principal food-fishes among local fishermen.
4. **Campostoma anomalum** (Rafinesque). (B, O.)
5. **Chrosomus erythrogaster** Rafinesque. (B.) Not common.
6. **Pimephales notatus** (Rafinesque). (B, O.) Common everywhere.
7. **Notropis whipplei** (Girard). (B, O.) Scarce.
8. **Notropis galacturus** (Cope). (B, O.) Especially abundant in Otter Creek.
9. **Notropis megalops** (Rafinesque). (B, O.) Seemingly scarce.
10. **Notropis umbratilis cyanocephalus** (Copeland). (O.) Not common.
11. **Hybopsis amblops** (Rafinesque). (O.)
12. **Hybopsis kentuckiensis** (Rafinesque). (B, O.) Only two small specimens were taken in Otter Creek; very common in Beaver Creek.
13. **Semotilus atromaculatus** (Mitchill). (B.) D. 7 or 8; A. 8.
14. **Fundulus catenatus** (Storer). (B, O.) Common.
15. **Lepomis cyanellus** Rafinesque. (B.) Only one.
16. **Lepomis megalotis** (Rafinesque). (B, O.) Scarce.
17. **Micropterus dolomieu** Lacépède. (O.) Many small specimens were taken.
18. **Etheostoma blennioides** Rafinesque. (B, O.)
19. **Etheostoma caprodes** (Rafinesque). (O.) The single specimen is 2¾ inches long.
20. **Etheostoma obeyense** Kirsch. (B, O.) Very abundant everywhere.
21. **Etheostoma cœruleum** Storer. (O.)

BIG SOUTH FORK OF THE CUMBERLAND RIVER.

The Big South Fork drains a scope of country lying north of the Cumberland Plateau in Tennessee, and extending from the watershed of the Obeys River system on the west to the Cross and Jellico mountain slopes on the east. It is tributary to the main stream of the Cumberland River at Burnside, Ky. This water system was investigated at the following places:

1. *Little South Fork*, September 5. This stream has its rise in the southern part of Wayne County, Ky.; it flows north and empties into the Big South Fork. The collections were made near the mouth of Canada Creek. Here the channel has an

average width of about 75 feet, its bottom mostly of smooth limestone covered with loose rocks. The stream is well stocked with fish. Collections are marked "L."

2. *Canada Creek* is in the southeast part of Wayne County, Ky., and tributary to Little South Fork. This stream was fished September 4 at a point about 8 miles above its mouth. The bottom of the channel is solid rock, having a width of about 30 feet. There are long stretches of deep and quiet water between the occasional shoals. Specimens from this creek are marked "C."

3. *Big South Fork*, near Whitley Station, Ky., September 7. This stream was examined on the shoals near the mouth of Rock Creek, about 7 miles west of Whitley Station, Ky. At this point the river has a width of about 300 feet, its bed is scattered over with large rocks, and the current is swift, making it almost impossible to seine. Specimens from here are marked "B."

4. *Rock Creek*, near Whitley Station, Ky. This stream is a western tributary of Big South Fork. It was investigated in its lower course September 7. It has a width of not more than 30 feet, the water is clear and cold, and, as the name indicates, the channel is very rocky. Fish from Rock Creek are marked "R."

5. *New River*, at New River Station, Tenn., on the Cincinnati Southern Railroad. This stream is formed in the east part of Scott County, Tenn. It flows north, and in conjunction with Clear Fork, White Oak Creek, and several other streams, forms the head waters of the Big South Fork. New River was investigated at New River Station September 9. The long stretches between the broad shoals are deep. The stream is well stocked with fish. Collections from this point are marked "N."

6. *Brimstone Creek*, New River Station. This stream has a length of only about 6 miles. It has a northerly course and is tributary to New River near New River Station. September 9 this little creek was seined for a distance of 1 mile. It has several gravelly shoals and many deep holes, with very muddy bottom. Fish small but very abundant. Specimens from this stream are marked "Br."

FISHES OF THE BIG SOUTH FORK OF THE CUMBERLAND RIVER.

1. **Catostomus nigricans** Le Sueur. (L, C, B, R, N, Br.) Common in all the streams.
2. **Moxostoma macrolepidotum duquesnei** (Le Sueur). (L, C, B, R.) Equally common.
3. **Lagochila lacera** Jordan & Brayton. (L, C.) Scarce.
4. **Campostoma anomalum** (Rafinesque). (L, C, R, N, Br.) A single specimen from Little South Fork; very abundant in the other streams.
5. **Pimephales notatus** (Rafinesque). (L, C.) Not common.
6. **Notropis heterodon** (Cope). (C.) Two small specimens only.
7. **Notropis whipplei** (Girard). (B, R, N, Br.) Common everywhere.
8. **Notropis galacturus** (Cope). (L, B, R, N, R.) Numerous specimens taken from all these streams.
9. **Notropis megalops** (Rafinesque). (L, C.) Common as usual.
10. **Notropis ariommus** (Cope). (R.) Two small specimens only.
11. **Notropis umbratilis cyanocephalus** (Copeland). (C, B, N, Br.) From the last point a single specimen.
12. **Notropis telescopus** (Cope). (C, B, R.) Rather common.
13. **Notropis atherinoides** Rafinesque. (L, C, B, R, Br.) Common everywhere except in Canada Creek.
14. **Hybopsis amblops** (Rafinesque). (L, C, R.)
15. **Hybopsis kentuckiensis** (Rafinesque). (L, C, B, N, Br.) Very common in all the streams except Brimstone Creek.

16. **Semotilus atromaculatus** (Mitchill). (C.) A few specimens only were secured.
17. **Fundulus catenatus** (Storer). (L, C.) Scarce.
18. **Ambloplites rupestris** (Rafinesque). (L, Br.)
19. **Lepomis megalotis** (Rafinesque). (L, C, B, Br.) Generally scarce.
20. **Micropterus dolomieu** Lacépède. (L, B, Br, C.) Common in flowing water.
21. **Micropterus salmoides** (Lacépède). (B, R, N, Br.) Common.
22. **Etheostoma simoterum atripinnis** (Jordan). (C.) Scarce.
23. **Etheostoma blennioides** Rafinesque. (L, C, R, N.) Common at all points.
24. **Etheostoma caprodes** (Rafinesque). (L, B, N, Br.)
25. **Etheostoma macrocephalum** Cope. (L.) Scarce.
26. **Etheostoma aspro** (Cope & Jordan). (B, Br.) Scarce.
27. **Etheostoma camurum** (Cope). (L, R.) Not common. Several small specimens.
28. **Etheostoma rufolineatum** (Cope). (L, B, R.) From swift waters. Scarce.
29. **Etheostoma cinereum** Storer. (L, R.) Scarce.
30. **Etheostoma obeyense** Kirsch. (L, C.) Scarce.
31. **Etheostoma cœruleum** Storer. (C, B, R.)
32. **Etheostoma stigmæum** (Jordan). (L, C, B, Br.)
33. **Cottus bairdi** Girard. (L.) Only a few small specimens were secured.

A large number of salamanders (*Amblystoma punctatum*) were taken in Rock Creek.

COLUMBIA CITY, IND., *November 4, 1892.*

8.—REPORT ON THE FISHERIES OF THE SOUTH ATLANTIC STATES.

INTRODUCTORY NOTE.

The accompanying report on the fisheries and fishery industries of the South Atlantic States is one of a series of special papers, some already published and others in course of preparation, relating to the economic fisheries of each geographical division of the coast States and emanating from the Division of Fisheries of the U. S. Fish Commission.

The article is based on a thorough investigation of the commercial fisheries of the region carried on by the field agents of the office during the years 1890 and 1891. The fisheries of not only the coastal waters of the section are included in the paper, but also those of the rivers emptying into the Atlantic Ocean, most of which were canvassed in their entirety. The scope of the report and the form of presentation make it the most detailed and complete statistical account thus far prepared on the fisheries of the South Atlantic States, and will, it is hoped, render it especially interesting and valuable for reference to those having a practical connection with the fishing industry as well as of general utility to those dealing with economic questions in the several States.

While there are certain branches of the fisheries in which the South Atlantic States take precedence, the industry, as a whole, is less important than in any other coast section. The report shows that in 1890 the number of persons here engaged in the fisheries was 16,001, the amount of capital invested was $1,688,286, and the first value of the products was $1,573,704. The shad is by far the most important single object of capture, after which come oysters, alewives, and mullet. The value of these four items is $1,036,285, a sum twice as large as that accruing from the sale of all the other products combined.

It is known that the fisheries of this region are capable of a much greater development than they have yet attained. The resources of the offshore banks, the littoral waters, and the lower courses of the rivers invite attention. It is probable that the most marked advance in the industry will occur as a result of the utilization of the facilities offered for the cultivation of oysters. In all these States the oyster has already received more or less attention from legislatures, local economists, capitalists, and the general government; and it seems only a question of a few years, under proper encouragement and methods, when the vast resources in the line of oyster production will be demonstrated.

The report has been prepared by Dr. Hugh M. Smith, acting assistant in charge of the Division of Fisheries. In the elaboration of the material he has had the assistance of Mr. W. de C. Ravenel and Mr. S. G. Worth, superintendent of Central Station, Washington, D. C., and late superintendent of fisheries of North Carolina, both of whom have an extended personal knowledge of the fisheries of this region.

The agents participating in the field investigations were Messrs. W. H. Abbott, Ansley Hall, and E. E. Race in North Carolina, and Charles H. Stevenson in North Carolina and South Carolina. The canvass of Georgia and Florida and of parts of North Carolina and South Carolina was made by Mr. W. de C. Ravenel, who was detailed from the Division of Fish-Culture.

MARSHALL MCDONALD,
U. S. Commissioner of Fish and Fisheries.

REPORT ON THE FISHERIES OF THE SOUTH ATLANTIC STATES.

BY HUGH M. SMITH, M. D.

I.—GENERAL REMARKS AND STATISTICS.

INTRODUCTION.

Note on the geography of the region.—The South Atlantic States as here considered are North Carolina, South Carolina, Georgia, and eastern Florida. The area of these States is 201,972 square miles and the population in 1890 was 4,989,302. The population of the counties having commercial fisheries and having a frontage on the coast, bays, or rivers, was 1,366,323. The principal cities and towns of the region on the coastal waters and rivers are Elizabeth City, Edenton, Plymouth, Washington, Newbern, Beaufort, and Wilmington, in North Carolina; Georgetown, Charleston, and Beaufort, in South Carolina; Savannah, Brunswick, Darien, and St. Marys, in Georgia, and Fernandina, Jacksonville, and St. Augustine, in Florida. These are also the most important fishing centers. The coast line following the general trend of the shore is about 950 miles in length, but the large number of islands, sounds, bays, and estuaries give a shore line four or five times longer.

Scope of the report.—The investigation on which this report is based was personally conducted by a part of the divisional force during 1890 and 1891. The statistical and other information relates to the years 1889 and 1890, and affords an excellent basis for comparison with the fisheries as they existed in 1880, when the U. S. Fish Commission instituted a careful inquiry in this region in behalf of the Tenth Census, the reports of which contain detailed chapters on the history, methods, and statistics of the coast and river fisheries of each State.* The present report is primarily intended to be a statistical account of the present condition of the fisheries of this region. The methods employed in the fisheries have undergone too few changes during the past decade to require a special discussion at this time. It will be sufficient to notice under each State the most marked differences as compared with 1880.

The plan of the statistical presentation contemplates a detailed exhibition of the fisheries of each State by counties and river basins. In some cases, where the fishery interests of two adjoining counties are closely commingled, the statistics have also been combined; and in the upper courses of some of the rivers where the fisheries are on a small scale a combination of the figures for several counties has been made.

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* The principal papers on the fisheries of this region are the following:

The Coast Fisheries of the South Atlantic States, by R. Edward Earll. <The Fisheries and Fishery Industries of the United States, section II, Geographical Review of the Fisheries for 1880.

The River Fisheries of the South Atlantic States, by Marshall McDonald. <The Fisheries and Fishery Industries of the United States, section V, History and Methods of the Fisheries.

The statistics presented may be regarded as covering all commercial fishing, both professional and semi-professional, prosecuted in the South Atlantic States. In addition to an examination of the general coast fisheries, which were canvassed in their entirety, the investigations were usually carried as far up the rivers as commercial fisheries existed. In nearly all the important rivers flowing into the Atlantic Ocean fisheries of greater or less extent are prosecuted; these are naturally most extensive in the lower courses of the rivers, but even in the headwaters of some of the longest streams, hundreds of miles from their mouths, semi-professional and desultory fishing is carried on. The time and force available for the work precluded a complete personal canvass of every river basin, but in each case the inquiry was carried to the farthest limit that circumstances seemed to require, with the result that the fishing in most of the streams was thoroughly covered, while in a few instances in which the fishing in the upper courses of the river was too scattered, remote, or unimportant to warrant a visit from the agents, careful estimates were obtained.

Illustrations are given of all the important marine, fresh-water, and anadromous food fishes of this region. The number of species figured is eighty-one. There is much confusion among fishermen and others regarding the identity and relations of many of the fishes as indicated by the common names in use, some of which are exceedingly inappropriate and misleading, and it is largely with a view to aid in the proper identification of the fish that the plates are presented. Under each figure the most appropriate common name or names and the scientific name are given, together with the local designations in the different States so far as they are known. In cases in which a name is assigned to no particular State, it has a more or less general distribution in the South Atlantic region. It is, of course, probable that many vernacular names are not recorded.

FISHERY RESOURCES OF THE SECTION.

The South Atlantic States occupy an intermediate position zoölogically as well as geographically as regards the Middle Atlantic and Gulf States, and in their coastal waters and rivers have fish, crustaceans, reptiles, and mollusks that are common to one or both of the adjoining regions. The resources of these States are great, but are less developed than those of any other section on the Atlantic seaboard.

There is a large variety and abundance of fishes inhabiting the pelagic, littoral, and fluvial waters of this region. Among the marine forms are certain subtropical fishes which occur in greater or less numbers, some of which reach the northern limit of their normal range or of greatest abundance south of Cape Hatteras; among these are the pompanos, mullets, and the grunts, snappers, and other sparoid fishes. Such generally distributed species as the bluefish, Spanish mackerel, menhaden, and squeteague are well represented. Some fish that are most plentiful off the New England and Middle Atlantic States are also found as far south as Florida in sufficient quantities to be objects of fisheries, such as the northern scup, sea bass, tautog, and butter-fish. The fishes that are resident in the brackish and fresh waters of the lowlands represent, in many respects, a fauna that is more or less characteristic of such regions; the predominance of the sunfishes (*Centrarchidæ*) both in species and individuals; the existence in abundance of such ganoid fishes as the dogfish (*Amia*) and gar pikes (*Lepisosteus*); and the occurrence in large numbers and varieties of catfishes (*Siluridæ*) and suckers (*Catostomidæ*), are prominent features of the fish life. The white perch (*Morone americana*) reaches the southern limit of its abundance in North Carolina, and in Albemarle Sound is an important food-fish. The migratory fishes, as shad, alewives, and striped bass, of which enormous bodies annually visit the region, are taken in large quantities in the lowlands. In the upper courses of most of the rivers, the most important commercial fishes are the suckers and sunfishes, besides the anadromous species mentioned, which often extend their migrations far up the streams.

The reptilian resources of this region comprise a number of valuable animals inhabiting the salt, brackish, and fresh waters. Three marine turtles occur; the most important of these is the green turtle (*Chelonia mydas*), which is valued for its eggs and the oil they yield, as well as for its flesh, which is highly esteemed. The other turtles are the loggerhead turtle (*Thalassochelys caretta*), which has little food value and is chiefly important for its eggs and the oil which is extracted from the flesh and eggs, and the hawkbill or tortoise-shell turtle (*Eretmochelys imbricata*), the shell of which constitutes its greatest value, the flesh and eggs being similar to those of the loggerhead. The snapping turtle (*Chelydra serpentina*) is found throughout the fresh waters of this region, but is not taken in large numbers for market, although it is a favorite article of food for home consumption. Foremost among the animals of this class is the diamond-back terrapin (*Malaclemmys palustris*), which is the most important reptilian product of these States, and is here taken in larger quantities than elsewhere in the United States, with the exception of the Chesapeake Bay region. Other terrapins of some commercial importance are the yellow-bellied terrapin (*Pseudemys scabra*) and the Florida cooter (*Pseudemys concinna*). One of the pond tortoises, locally called the "chicken tortoise" (*Chrysemys reticulata*), also has some economic value. The alligator (*Alligator mississippiensis*) is found in all the South Atlantic States, but is scarce in the more northern parts of the region and is the object of an established industry only in Florida.

During the colder months, large numbers of porpoises congregate south of Cape Hatteras, where they are captured by means of large seines; this fishery is more important in North Carolina than in any other State, and nowhere else is the seine used for taking porpoises. Other cetaceans occur off this coast at times, but they are not now captured by the fishermen of this region.

The only mollusk which has up to this time attained commercial prominence is the oyster (*Ostrea virginica*). This occurs in every State; is, next to the shad, the most important single fishery product of the region, and is doubtless destined, in the near future, to occupy a much more prominent position among the food resources of these States, as a result of the increased attention it is receiving from the general government, State legislatures, economists, and cultivators. The round or hard clam or quahog (*Venus mercenaria*) is found in some abundance in parts of this region and is taken in small quantities in North Carolina, Georgia, and Florida. The only other mollusk which has become an object of fishery is the scallop (*Pecten irradians*), of which limited quantities are secured in North Carolina.

Among crustaceans the shrimp are the most important representatives occurring on the South Atlantic coast. Two species (*Penæus setiferus* and *P. brasiliensis*) are taken in large numbers throughout the region, the small individuals often being denominated shrimp, while the larger examples are called prawn. The shrimps here reach a larger size than on the coast of the New England and Middle States and are much more abundant than in those sections. The yield is at present much less than the resources would warrant, and is largely limited by the demand. Crabs are abundant in the salt and brackish water of the region, but no very important fishery is prosecuted for them. The common blue crab (*Callinectes hastatus*), which is called "channel crab" at some places in North Carolina and "sea crab" in the other States, abounds along the coast and is the principal species taken for food and bait. The stone crab (*Menippe mercenaria*), the only other species of crab having economic value, is larger, less abundant, and more highly esteemed as food than the blue crab; it is found from North Carolina to Florida.

IMPORTANCE AND CHARACTER OF THE FISHERIES.

Considered in the aggregate, the fisheries of this region are less extensive and important than those of any other section of the United States. The amount of capital invested, the quantity of products taken, and the value of the yield are all less than in the next important fishing region—the Gulf States. In the number of persons engaged in the industry, however, the South Atlantic States take precedence over the Gulf and Pacific States. The explanation of the apparent disproportion between the investment and yield on one hand and the personnel on the other lies in the fact that there is an unusually large semi-professional element in the river fisheries, where the apparatus is of an inexpensive nature and the catch is small.

The most important fisheries of this region are those for shad, oysters, alewives, mullets, black bass, bluefish, striped bass, squeteague, sea bass, and shrimp, the value of each of which is from $25,000 to $482,400, the aggregate value of these ten items being $1,266,903, or about four-fifths of the total yield of the fisheries of the region. The specially prominent species are shad, oyster, alewives, and mullets; of these, it is only in the alewife fishery that this section surpasses all others, but among minor branches the black-bass, porpoise, and sucker fisheries also rank first on the Atlantic seaboard. Of the individual coastal States, North Carolina leads in the value of the alewife, black-bass, and porpoise fisheries, which are among those in which the region as a whole takes precedence.

One of the most prominent features of the fisheries of the South Atlantic States is the comparative unimportance of the vessel fishery. Fewer vessels are employed than in any other coast section, and their use is almost restricted to the oyster fishery; although in North Carolina there is a small fleet engaged in the menhaden fishery, and in this State and in South Carolina and Georgia vessels are sparingly used in the turtle, terrapin, and hand-line fisheries. The abundance of fish in the river and the shore waters has, up to this time, precluded the necessity of resorting to the offshore fishing-grounds where the use of vessels is required.

Numerous forms of apparatus are employed in the South Atlantic fisheries, some of which are used in large quantities and some only sparingly. The principal kinds are set or stake gill nets and drift gill nets, haul seines, sweep seines, purse seines, pound nets, weirs, fyke nets, cast nets, skim nets, dip nets, and lines, employed in the capture of fish; seines in the taking of porpoises, shrimps, terrapins, turtles, and crabs; cast nets for shrimps; lines for crabs, and tongs for oysters, clams, and scallops. Fish wheels and wooden traps were also at one time somewhat extensively employed in the head waters of some of the rivers, but these are now of little commercial importance.

In the ocean and general salt-water fisheries lines are the principal means of capture; the largest quantities of sea bass, whiting, sheepshead, squeteague, channel bass, drum, etc., are thus taken. In the waters of the sounds, bays, and lower courses of the rivers, gill nets and seines are the predominant types in the capture of shad, alewives, black bass, mullet, bluefish, channel bass, and sturgeon; in North Carolina pound nets are also important in taking alewives, shad, and striped bass. In the upper parts of the rivers skim nets, dip nets, and small gill nets are the characteristic apparatus, and the principal fish caught are shad, alewives, and suckers.

A consideration of the forms of apparatus employed in the food-fish fisheries of the South Atlantic States shows that the use of seines and gill nets is so much more extensive than that of any other form, except in North Carolina, that all other apparatus is unimportant by comparison, and that some types which in other regions constitute a very prominent means of capture are entirely absent or only sparingly used in the greater part of the South Atlantic region. The pound net, for instance, is found practically only in one State, and the fyke net is employed only in very small numbers and in isolated localities. The possibility of introducing new forms which will develop the fishing resources, increase the income of the fishermen, and at the same time mitigate their labors, seems worthy of serious attention. Both the pound and fyke nets are adapted to the capture of almost every species of marine, fresh-water, and anadromous fish occurring in the region, and the topography of the shores is extremely favorable to their employment. Their inexpensiveness, as compared with seines, recommends them, and the possibility of employing them in connection with seine, gill-net, and other fisheries without special increase in the working force is an important consideration.

A conspicuous instance of the advantage which may come to a locality through the use of improved means of capture is seen in the Albemarle region of North Carolina, where, within a comparatively few years, the pound net by its introduction and extensive operation in the shad, alewife, striped bass, and other fisheries is displacing the more expensive and less effectual apparatus, and the wonderful resources of the waters of the section are more fully demonstrated and utilized than ever before.

The introduction of modern improved apparatus should not be undertaken without a due consideration of the limitations in its use and without the enaction by legislatures of provisions for the proper protection of the fish sought to be caught. Such forms as the pound net and fyke net can, in most localities, be regarded as legitimate means of capture whose proper use will result in no appreciable diminution in the abundance of the fish caught; but when no restrictions are placed on the number that may be set in a given river, bay, or estuary, the season for their operation, the size of the mesh in leader and bowl, and their position with reference to the interference with the movements of anadromous or other migrating fish on their way to the spawning-grounds, they are capable of doing vast injury, which years of artificial stocking may not effectually overcome. In some of the States to the north a serious decline in the catch of shad and other fish in certain rivers may be directly traced to the reckless setting of pound nets at the mouths of rivers in such numbers or such position that practically the entire body of migrating fish is caught before the process of reproduction supervenes.

STATISTICAL PRESENTATION.

Condensed statistics covering various phases of the fisheries of the South Atlantic States are contained in the following tables. The specification is by States. A series of three tables is first presented, showing the number of persons engaged in the industry, the number and value of the vessels, boats, nets, etc., employed, and the quantity and value of the principal products taken. From Table 1 it will be seen that 16,001 persons found employment in the fisheries of this region in 1890, of whom 12,650 were fishermen and 3,351 were shoresmen. The investment in fishing property, as shown in Table 2, was $1,688,286, of which $159,164 represented vessels, $259,803 boats, $418,609 apparatus, and $850,710 shore, accessory, and cash property. The amount of the catch as given in Table 3 was 67,201,630 pounds, for which the fishermen received $1,573,704. Of this sum $482,403 accrued from the sale of shad, $254,141 from oysters, $166,106 from alewives, $133,635 from mullet, and $537,419 from all other products.

1.—Table showing the number of persons employed in the fisheries of the South Atlantic States in 1890.

States.	Fishermen.	Shoresmen.	Total.
North Carolina	7, 478	2, 796	10, 274
South Carolina	2, 577	124	2, 701
Georgia	1, 421	201	1, 622
Florida	1, 174	230	1. 404
Total	12, 650	3, 351	16, 001

2.—Table showing the number and value of vessels, boats, and apparatus, and the value of the shore property and cash capital employed in the fisheries of the South Atlantic States in 1890.

Items.	North Carolina.		South Carolina.		Georgia.		Florida.		Total.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels	128	$101, 029	15	$29, 325	23	$26, 800	3	$2. 010	169	$159, 164
Tonnage	1, 615. 59		240. 04		267. 74		39. 25		2, 162. 62	
Boats	3, 862	188, 375	1, 227	31, 804	788	9, 766	716	29, 858	6, 593	259, 803
Seines	1, 273	99, 649	74	4, 008	51	2. 052	359	7, 480	1, 757	113, 189
Gill nets	90, 980	154, 582	1. 380	13, 958	398	7, 957	468	27, 730	93. 226	204, 227
Pound nets	950	80, 394			5	1. 250	5	570	960	82, 214
Fyke nets	36	384			11	285			47	669
Pots	1, 165	1, 755							1, 165	1, 755
Skim and other minor nets	728	2, 798	734	2, 464	383	1. 017			1, 845	6, 279
Cast nets					148	740	203	1. 028	351	1, 768
Lines		57		562		306		630		1, 555
Tongs	1, 479	4, 457	169	1, 116	157	898	59	280	1, 864	6, 751
Minor apparatus		202								202
Shore and accessory property		306, 506		27, 525		51, 560		49, 919		435, 510
Cash capital		303, 800		17. 000		71, 800		22. 600		415. 200
Total		1, 243, 988		127, 762		174, 431		142, 105		1, 688, 286

3.—Table showing the quantity and value of products taken in the fisheries of the South Atlantic States in 1890.

Species.	North Carolina.		South Carolina.		Georgia.		Florida.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	16.481.063	$164.636	28.600	$740	24.000	$580	10,120	$150	16,543,783	$166,106
Black bass	407,530	20,492	2,100	107			181,646	9.832	591 276	30,431
Bluefish	1.345,194	33,603	100.480	3,060			7,310	255	1,452.984	36,918
Bream and perch	609.474	22.769	104,635	5,204	18,400	888	588,190	20,235	1,320,699	49,096
Catfish	53.685	1,246	129.051	4,523	192.232	8,175	96,240	1,265	471,208	15,209
Channel bass and drum	165,815	1,919	273,028	5,326	53,870	2,515	199,290	5,737	692,003	15,497
Menhaden	12,410,400	16,171							12,410.400	16,171
Mullet	3,585,981	97,408	387,875	9.405	52.740	2,381	1.547.027	24.441	5.573,623	133,635
Sea bass	33,075	1,158	826,164	26,283	10.000	600	10,445	355	879,684	28,396
Shad	5,768,413	306,015	563,259	41,187	399,660	30,918	2,654.022	104,283	9.385,354	482,403
Sheepshead	146.345	5.981	39,100	1,256	5,000	300	274.113	8,358	464.558	15,895
Spots and croakers	719,725	18,729	41.670	1,450	13,800	790	24.133	802	799,328	21,771
Squeteague	1,885,677	48,856	103.106	3,604	144,000	7,911	235.284	7,895	2,368,067	68,266
Striped bass	568.341	32,138	11,560	1.084	9.000	720			588,901	33,942
Sturgeon	175,210	4,467	203,962	3.850	80,560	1.497	28,055	560	487,787	10,374
Whiting	35,300	231	523,520	20.930	18.374	1,060	14,020	545	591.214	23,766
Miscellaneous fish	1,277,065	45,661	612,495	20,701	141.920	7.720	764,336	11,169	2,795.816	85,251
Oysters	5,650,820	75,567	442.050	23,204	1,570,485	40.520	681.450	14,850	*8,344.805	254,141
Quahogs	226.152	12,090			4,000	300	5,600	350	†235,752	12,740
Scallops	18,000	800							‡18.000	800
Crabs	47,400	1,185	93,260	1,740	47,866	1,060	4.100	185	192,626	4,170
Shrimps	144.200	5,435	371,840	18.592	162,160	6,081	65,825	2,557	744,025	32,665
Terrapins	26,552	4,690	74,948	8,376	43,050	9,107	10,350	1,425	154,900	23,598
Turtles	17,725	1,024					60,100	4,441	77,825	5,465
Porpoises		4,398							(§)	4,398
Total	51,799,142	1,027.669	4,932,703	200,622	2,991,117	123,123	7.461,656	219,690	67,184,618	1,571,104

* 1,192,115 bushels. † 29,469 bushels. ‡ 4,000 bushels. § 1,747 in number.

Note.—The following quantities of caviare, prepared from sturgeon roe, were made by the fishermen in 1890: South Carolina, 12,137 pounds, worth $1,980; Georgia, 3,000 pounds, worth $440; Florida, 1,875 pounds, worth $180. These items are to be added to the above in order to show the total results of the fisheries.

Another series of three tables illustrates special features of the fisheries as regards the products.

The importance of the various forms of apparatus employed in the capture of fish and other products is exhibited in the following table. Seines are credited with the largest and most valuable catch, 33,164,442 pounds, worth $517,308, being taken in this way. Gill nets rank next, with 11,575,164 pounds, valued at $450,891. Tongs occupy the third position, taking 8,598,557 pounds (of the edible parts of oysters, clams, etc.), for which $267,681 was received. Lines took 3,903,729 pounds, worth $132,697. With pound nets a much larger yield was made than with lines, viz, 8,410,972 pounds, but the value of the same was only $126,256. The order of importance of the remaining forms of apparatus is skim and cast nets, pots, and fyke nets.

4.—Table showing the quantities and values of products taken in each kind of apparatus employed in the fisheries of the South Atlantic States in 1890.

Apparatus.	North Carolina.		South Carolina.		Georgia.		Florida.		Total.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines	30,314,862	$423,736	614,078	$23,075	65,830	$10,120	2.169,672	$60,377	*33,164,442	$517,308
Gill nets	6,354,178	252,249	793,730	42.474	611,662	37,503	3,815,594	118,665	11,575,164	450,891
Pound nets	8,282.562	123,606			41,695	1,285	86,715	1,365	8,410.972	126,256
Fyke nets	24,885	716			20,190	898			45.075	1,614
Skim nets and cast nets	304.148	12,746	514,956	28,273	277,467	13,747	187,487	6,321	† 1,284,058	61,087
Pots	153,415	9,222							153,415	9,222
Lines	444,275	14,583	2.541,303	81,225	401,138	18,947	517,013	17,942	‡ 3,903,729	132,697
Tongs	5,894,972	188,457	442,050	23,204	1,574.485	40,820	687,050	15,200	8,598,557	267,681
Minor apparatus	25.845	2,354	38,723	4,351	1,650	243			66.218	6,948
Total	51,799,142	1,027,669	4,944,840	202,602	2,994,117	123,563	7.463,531	219,870	67,201,630	1,573,704

* Includes shrimps, terrapins, and turtles. † Includes shrimps. ‡ Includes crabs.

It is interesting to observe the different average values of the products taken in the various kinds of apparatus. From the preceding table the following average prices per pound may be deduced:

Average values of products taken in different forms of apparatus.

Means of capture.	Price per pound.
	Cents.
Seines	1.56
Gill nets	3.89
Pound nets	1.50
Fyke nets	3.58
Skim nets and cast nets	4.75
Pots	6.01
Lines	3.39
Tongs	3.11
Minor apparatus	10.49
Total	2.34

In Table 5 the values of the fisheries for the different classes of products are given for each State. The general food-fish fisheries, valued at $1,219,556, greatly outrank the combined yield of all the other fisheries and surpass by nearly $1,000,000 the value of the next prominent branch—the molluscan fisheries. The taking of shrimps and crabs ranks third in importance, followed by the reptilian, menhaden, and mammalian fisheries, the two last named existing in only one State.

5.—Table showing the values of the different fisheries of the South Atlantic States in 1890.

Fisheries.	North Carolina.	South Carolina.	Georgia.	Florida.	Total.
General food-fish	$806, 309	$150, 690	$66, 495	$196, 062	$1, 219, 556
Menhaden	16, 171				16, 171
Mammalian	4, 398				4, 398
Reptilian	5, 714	8, 376	9, 107	5, 866	29, 063
Crustacean	6, 620	20, 332	7, 141	2, 742	36, 835
Molluscan	188, 457	23, 204	40, 820	15, 200	267, 681
Total	1, 027, 669	202, 602	123, 563	219, 870	1, 573, 704

About five-ninths of the money accruing from the fisheries of this region represent fresh-water products. The fresh-water fisheries of North Carolina and Florida are considerably more important than those prosecuted in salt water. The relative extent of the river and other fresh-water fisheries of the South Atlantic States is probably greater than in any other coast section and constitutes one of the principal features of the industry. From the following table it will be seen that in 1890 the salt-water products had a value of $740,539 and the fresh-water were worth $833,165.

6.—Value of the products of the salt-water and fresh-water fisheries of the South Atlantic States in 1890.

States.	Salt-water fisheries.	Fresh-water fisheries.	Total.
North Carolina	$453, 944	$573, 725	$1, 027, 669
South Carolina	137, 530	65, 072	202, 602
Georgia	80, 212	43, 321	123, 563
Florida	68, 823	151, 047	219, 870
Total	740, 539	833, 165	1, 573, 704

COMPARISONS BETWEEN 1880 AND 1890.

Data are available for an interesting and important comparison between the present extent of the fisheries of the South Atlantic States and their condition in 1880. The exhibition of the changes which have occurred during this decade, as given in the following tables, constitutes one of the most valuable uses which the statistics subserve.

From Table 7 it will be observed that there has been a marked increase in the number of persons engaged in the industry, the advance being participated in by every State. The number of fishermen increased 5,800, the number of shoresmen was augmented by 2,655, and the total increase in the fishing population was 8,455, or more than 100 per cent. The order of rank of the States as regards their numerical increase was North Carolina, South Carolina, Florida, and Georgia. The ratio of increase was greatest in Florida, after which came South Carolina, North Carolina, and Georgia.

A comparative statement of the vessels, boats, and apparatus used in 1880 and 1890 is given in Table 8. An increase in the invested capital, amounting to $993,126, is seen to have taken place in all the States. The increase is in the number and value of vessels, boats, and almost every form of apparatus, but is especially marked in the items of boats, pound nets, gill nets, and shore property and cash capital. The largest advance is in North Carolina, where the fishery investment was $737,427 more in 1890 than in 1880; the percentage of increase, however, was greatest in Florida.

The value of the fisheries in 1890 exceeded by $317,126 that of 1880. The increase was largest in North Carolina, where it aggregated $181,974, and was smallest in Georgia, where it amounted to only $3,570; while in South Carolina there was a decrease of $9,880. The advance was relatively greatest in Florida, being $141,462, or over 180 per cent. Among fish, every important species, except sturgeon, has an increased value, considering the entire region, although in North Carolina the shad shows a decrease, owing to a reduction in the average price, the quantity taken being much larger than in 1880. The increase in the value of the fish caught was $185,479, of which $102,325 represented shad. The sturgeon fishery declined $45,725. Next to fish, the largest advance has been in mollusks, especially oysters. The increase in oysters in the ten years intervening between the two investigations was $134,141, although the net increase in mollusks was only $126,826, owing to a decline in the clam fishery. The value of the reptiles taken in the fisheries of this region appears to have increased $14,413, although the result of the terrapin fishery in North Carolina in 1890 was $6,160 less than in 1880. A decrease in the catch of crustaceans aggregating $13,990 is to be observed, depending on a falling off in the shrimp fishery of South Carolina. The entire value of the porpoise fishery in 1890 is a gain over 1880, in which year no porpoises were taken. The details of the changes in the fisheries of the several States during the decade are brought out in Table 9.

7.—Comparative statement of the number of persons engaged in the fisheries of the South Atlantic States in 1880 and 1890.

States.	Fishermen.			Shoresmen.			Total.			
	1880.	1890.	Increase.	1880.	1890.	Increase.	1880.	1890.	Increase.	
									Number.	Per cent.
North Carolina	4,729	7,478	2,749	545	2,796	2,251	5,274	10,274	5,000	94.80
South Carolina	964	2,577	1,613	41	124	83	1,005	2,701	1,696	168.76
Georgia	809	1,421	612	90	201	111	899	1,622	723	80.42
Florida	348	1,174	826	20	230	210	368	1,404	1,036	281.52
Total	6,850	12,650	5,800	696	3,351	2,655	7,546	16,001	8,455	112.05

8.—Comparative statement of the vessels, boats, apparatus, and property employed in the fisheries of the South Atlantic States in 1880 and 1890.

States.	Vessels.				Boats.				Seines.			
	Number.		Value.		Number.		Value.		Number.		Value.	
	1880.	1890.	1880.	1890.	1880.	1890.	1880.	1890.	1880.	1890.	1880.	1890.
North Carolina	95	128	$39,000	$83,550	2,714	3,862	$123,175	$188,375	835	1,273	$95,982	$99,649
South Carolina	22	15	15,000	24,800	501	1,227	9,790	31,804	44	74	2,725	4,008
Georgia	1	23	450	21,025	358	788	15,425	9,766	17	51	800	2,052
Florida	......	3	....	1,750	315	716	12,950	29,858	16	359	1,060	7,480
Total	118	169	54,450	131,125	3,888	6,593	161,340	259,803	912	1,757	100,567	113,189

States.	Pound nets.				Gill nets.				Value of other apparatus and outfit.		Shore and cash property.	
	Number.		Value.		Number.		Value.					
	1880.	1890.	1880.	1890.	1880.	1890.	1880.	1890.	1880.	1890.	1880.	1890.
North Carolina	117	950	$30,800	$80,394	18,796	90,980	$43,290	$154,582	$55,364	$27,132	$118,950	$610,306
South Carolina	......	......	....	....	66	1,380	3,415	13,958	19,845	8,667	15,500	44,525
Georgia	......	5	....	1,250	251	398	9,120	7,957	8,525	9,021	44,450	123,360
Florida	......	5	....	570	172	468	11,915	27,730	5,129	2,198	12,500	72,519
Total	117	960	30,800	82,214	19,285	93,226	67,740	204,227	88,863	47,018	191,400	850,710

States.	Total investment.			
	1880.	1890.	Increase.	
			Amount.	Per cent.
North Carolina	$506,561	$1,243,988	$737,427	145.57
South Carolina	66,275	127,762	61,487	92.78
Georgia	78,770	174,431	95,661	121.44
Florida	43,554	142,105	98,551	226.27
Total	695,160	1,688,286	993,126	142.86

9.—Comparative statement of the values of the principal products of the fisheries of the South Atlantic States in 1880 and 1890.

Products.	North Carolina.			South Carolina.		
	1880.	1890.	Increase or decrease.	1880.	1890.	Increase or decrease.
Fish:						
Alewives	$142,784	$164,636	+$21,852	$9,000	$740	—$8,260
Bluefish	12,000	33,603	+ 21,603	4,000	3,060	— 940
Mullet	80,500	97,408	+ 16,908	7,210	9,405	+ 2,195
Shad	329,569	306,015	— 23,554	12,432	41,187	+28,755
Squeteague	25,550	48,856	+ 23,306	10,300	3,604	— 6,696
Sturgeon	18,094	4,467	— 13,627	15,675	5,830	— 9,845
Others	145,823	167,495	+ 21,672	90,365	86,864	— 3,501
Total	754,320	822,480	+ 68,160	148,982	150,690	+ 1,708
Reptiles:						
Terrapins	10,850	4,690	— 6,160	1,950	8,376	+ 6,426
Turtles*	....	1,024	+ 1,024	....	....	....
Total	10,850	5,714	— 5,136	1,950	8,376	+ 6,426
Crustaceans:						
Shrimps	4,500	5,435	+ 935	37,500	18,592	—18,908
Crabs	450	1,185	+ 735	750	1,740	+ 990
Total	4,950	6,620	+ 1,670	38,250	20,332	—17,918
Mollusks:						
Oysters	60,000	175,567	+115,567	20,000	23,204	+ 3,204
Clams	15,575	12,090	— 3,485	3,300	....	— 3,300
Scallops	....	800	+ 800	....	....	....
Total	75,575	188,457	+112,882	23,300	23,204	— 96
Mammals:						
Porpoises	....	4,398	+ 4,398	....	....	....
Grand total	845,695	1,027,669	+181,974	212,482	202,602	— 9,880

Products.	Georgia.			Florida.			Total		
	1880.	1890.	Increase or decrease.	1880.	1890.	Increase or decrease.	1880.	1890.	Increase or decrease.
Fish:									
Alewives	$3,750	$580	—$3,170	$200	$150	— $50	$155,734	$166,106	+$10,372
Bluefish	100	....	— 100	500	255	— 245	16,600	36,918	+ 20,318
Mullet	4,100	2,381	— 1,719	20,787	24,441	+ 3,654	112,597	133,635	+ 21,038
Shad	17,941	30,918	+12,977	20,136	104,283	+ 84,147	380,078	482,403	+102,325
Squeteague	2,280	7,911	+ 5,631	2,225	7,895	+ 5,670	40,355	68,266	+ 27,911
Sturgeon	24,780	1,937	—22,843	150	740	+ 590	58,699	12,974	— 45,725
Others	24,617	22,768	— 1,849	25,380	58,298	+ 32,918	286,185	335,425	+ 49,240
Total	77,568	66,495	—11,073	69,378	196,062	+126,684	1,050,248	1,235,727	+185,479
Reptiles:									
Terrapins	1,650	9,107	+ 7,457	200	1,425	+ 1,225	14,650	23,598	+ 8,948
Turtles*	....	....	....	....	4,441	+ 4,441	....	5,465	+ 5,465
Total	1,650	9,107	+ 7,457	200	5,666	+ 5,666	14,650	29,063	+ 14,413
Crustaceans:									
Shrimps	4,000	6,081	+ 2,081	3,500	2,557	— 943	$49,500	$32,665	—$16,835
Crabs	125	1,060	+ 935	....	185	+ 185	1,325	4,170	+ 2,845
Total	4,125	7,141	+ 3,016	3,500	2,742	— 758	50,825	36,835	— 13,990
Mollusks:									
Oysters	35,000	40,520	+ 5,520	5,000	14,850	+ 9,850	120,000	254,141	+134,141
Clams	1,650	300	— 1,350	330	350	+ 20	20,855	12,740	— 8,115
Scallops	....	....	....	....	....	....	....	800	+ 800
Total	36,650	40,820	+ 4,170	5,330	15,200	+ 9,870	140,855	267,681	+126,826
Mammals:									
Porpoises	....	....	....	....	....	....	....	4,398	+ 4,398
Grand total	119,993	123,563	+ 3,570	78,408	219,870	+141,462	1,256,578	1,573,704	+317,126

*** Not reported in 1880, although probably taken. The comparison of the reptile catch is therefore unsatisfactory.**

II.—FISHERIES OF NORTH CAROLINA.

GEOGRAPHICAL FEATURES OF THE COAST.

The coast of North Carolina, following the outer shores, is only about 300 miles long, but if the sounds, estuaries, and other indentations are considered, the length is nearly 1,500 miles, along the entire extent of which the prosecution of commercial fishing is made possible by the configuration of the shores and the adjoining bottom; the absence of high or rocky shores and the preponderance of low, sandy stretches and shallow water areas permitting the employment of pound nets, seines, and gill nets under the most favorable circumstances.

The characteristic physical features of the coastal regions of North Carolina are (1) the low, narrow, sandy islands and peninsulas which skirt nearly the whole ocean front of the State, between which and the mainland are (2) numerous sounds, some of large size, which are the principal fishing-grounds, while (3) the mainland is very irregular in outline and is intersected by a number of large and small streams, the most important of which are the Pasquotank, Chowan, Roanoke, Alligator, Pamlico, Neuse, and Cape Fear rivers.

The principal cities and towns on the coast, bays, and rivers are Elizabeth City, Hertford, Edenton, Plymouth, Columbia, Manteo, Washington, Newbern, Kinston, Beaufort, Morehead City, and Wilmington, which are also the chief fishing centers of the State.

FISHING-GROUNDS.

The principal fishing-grounds of the State are the sounds and the lower courses of the streams emptying into them. Fishing in the upper courses of the rivers is usually of a non-commercial nature and is unimportant. There is also at certain points along the coast a limited fishery in the ocean for typically salt-water fish. The principal sounds of North Carolina are Currituck, Albemarle, Croatan, Roanoke, Pamlico, Core and Bogue, each of which deserves special notice.

Currituck Sound.—This is the most northern sound in the State. It runs parallel with the coast and extends from the Virginia State line to the eastern end of Albemarle Sound, with which it merges. It is 40 miles in length and from 3 to 4 miles in width. For a body of water of such size the depth is extremely shallow, in no place being more than 9 feet. Except during periods of dry weather the water is fresh, although at one time it communicated freely with the ocean by means of Caffey Inlet, which was closed in the year 1800. Prior to this time the sound contained marine fish, but at present only fresh-water and anadromous fishes are found in it. Black bass (locally called chub) and white perch are very abundant, and at the proper season striped bass and herring enter the sound in considerable numbers. The catch of black bass is probably greater than in any other part of the State, if not the largest in the country. The region is annually visited by enormous numbers of wild fowl, and is one of the most noted hunting resorts on the Atlantic coast. The only settlement of note on the sound is Currituck, situated near its head.

Albemarle Sound and tributaries.—This sound has the distinction of being the largest coastal body of fresh water in the world. Its extreme length from east to west is 60 miles, and its maximum width is 15 miles, the average being 6 or 8 miles; it therefore contains about 450 square miles. The water is normally quite fresh, but during periods of excessively dry weather it becomes salt or brackish, especially at its eastern end, where it drains into Roanoke and Croatan sounds. Of all the North Carolina sounds this is the most important from a fishery standpoint; and it is probable that there are few bodies of water of similar size in the world having more extensive fisheries. The importance is due to the fact that (1) the region is annually visited by enormous bodies of shad, alewives, striped bass, and other desirable economic species, and (2) the natural conditions permit the employment of seines, pound nets, gill nets, and other devices in almost limitless numbers. It is especially remarkable for its level bottom and uniform depth of water, and the absence of strong currents and tides, except those of infrequent occurrence resulting from gales. Eight rivers enter the sound, four on the north, two on the west, and two on the south, in nearly all of which more or less extensive fisheries are carried on. The Chowan and Roanoke rivers, which flow into the western end of the sound, are among the longest and most important in the State, and have large fisheries in the portion adjacent to their mouths. The North, Pasquotank, Little, and Perquimans rivers on the north and the Scuppernong and Alligator rivers on the south are short, wide streams, the most important, as regards fisheries, being the Pasquotank and Alligator.

Roanoke and Croatan sounds.—These lie to the south of the eastern end of Albemarle Sound and extend parallel with the coast; they are separated by Roanoke Island. Roanoke Sound lies to the east of the island, and is 8 miles long and 1½ to 2 miles wide. It is very shallow throughout its length, except in a narrow channel which skirts the shore of the island. Croatan Sound has the same length as Roanoke Sound, but is 2 to 4 miles wide and is much deeper. Most of the drainage from Albemarle Sound passes through it. The combined aréa of these bodies of water is about 75 miles. Important gill-net and other fisheries are prosecuted in these sounds. The southern extremities contain small deposits of native oysters, and the area probably suitable for oyster culture and planting is about 9,000 acres.

Pamlico Sound and tributaries.—With the exception of Long Island Sound, this is the largest sound on the Atlantic coast of the United States. It is about 75 miles long and from 10 to 30 miles wide, the area being about 1,860 square miles. On the north it communicates with Albemarle Sound through Roanoke and Croatan sounds, and much of the water of Albemarle Sound finds entrance into the ocean through it; on the south it joins Core Sound. The general depth is 15 to 20 feet. The sound is separated from the sea by long, narrow strips of sandy land, called the "Banks," through which the water of the sound finds exit at New, Hatteras, and Ocracoke inlets. The land known as the "Banks" consists chiefly of low, desolate, barren sand hills, with occasional patches of scrubby vegetation. The inhabitants now depend for their livelihood almost entirely on fishing, oystering, and clamming, although in earlier times the region was the home of a class who made their living from the wrecks which were numerous on this coast. Two important rivers, the Pamlico and the Neuse, enter the sound from the west, their mouths being broad estuaries in which considerable fishing is done.

Pamlico Sound contains a great wealth of both fresh-water and salt-water fish. The large bodies of anadromous fish, which occur in the sounds to the north, all pass through Pamlico Sound. The salinity of the water permits the entrance of menhaden, squeteague, spots, mullet, sheepshead, whiting, hogfish, bluefish, etc., in large numbers. Extensive areas are covered with a natural growth of oysters, which have recently attained marked prominence and are now, next to shad, the most valuable fishery product of the State. The possibilities of the waters of the sound and its tributaries for oyster-culture are believed to be very great. Lieut. Francis Winslow found, as the result of careful surveys, that the area of the natural oyster beds was 7,400 acres, and the area of the bottom that is probably suitable for planting is 620,206 acres, while the possible ground available for the purpose is 718,868 acres.

Core and Bogue sounds.—Communicating with Pamlico Sound on the north, and extending first in a southwesterly and then in a westerly direction, is a long and narrow body of water about 50 miles in length and from 1 to 6 miles in width, known as Core and Bogue sounds. Their area is about 165 square miles. These communicate with the ocean through Beaufort, Bear, and Bogue inlets. The water is very shoal, varying from 1 to 10 feet, and not averaging more than 4 or 5. The people living on the shore of these sounds are very generally dependent on the water for a livelihood, and the fisheries carried on are very extensive. The principal species taken are mullet, squeteague, bluefish, spot, hogfish, Spanish mackerel, and whiting. The catch of the two first-named fish in Core Sound is larger than in any other body of water on the Atlantic coast.

About 2,800 acres of bottom in these sounds are covered with native oysters, and, according to Lieut. Winslow, 68,300 acres are probably suitable for oyster-planting.

Other sounds and rivers.—South of Bogue Sound the coast is fringed with five small, shallow sounds, known as Stump, Topsail, Middle, Masonboro, and Myrtle sounds. These have but little bearing on the fisheries at present and are chiefly important because of the possibilities they have for oyster production and cultivation. White Oak and New rivers, the only streams of importance between Beaufort Entrance and the Cape Fear River, also have natural oyster beds. New River is said to contain some of the finest oyster-ground in the world, although the absence of shipping facilities has, until recently, retarded the development of this important resource.

Ocean fishing-grounds.—Fishing in the ocean is prosecuted with gill nets and seines at many places along the coast, but is especially important on the shore between Cape Hatteras and Currituck Sound, where the winter fishery for bluefish has become famous. The other species taken in greatest numbers are trout, spot, mullet, drum, whiting, Spanish mackerel, and sheepshead. In the vicinity of Wilmington, considerable line-fishing is done at times on the blackfish banks located several miles offshore, sea bass, grunts, and pigfish being the species taken. The shore between Cape Hatteras and Bogue Inlet has a number of seine fisheries for porpoises, which congregate in this region in large numbers during the colder months.

IMPORTANCE OF THE FISHERIES.

The fishing industry of North Carolina ranks as one of the most important business enterprises of the State, and in the coastal regions is no doubt of greater value than any other single branch of trade. There are few States having so large a population so entirely dependent on the fisheries for a livelihood, and there are few sections in which the general facilities for prosecuting the industry are more favorable. The fisheries, therefore, possess a great economic interest to the State and indirectly to the country at large; and a proper knowledge of the extent, condition, and needs of the industry becomes of considerable importance to the citizens of the commonwealth.

In 1880 North Carolina occupied the tenth rank among the coast States, this position being determined by the value of the products. In 1888, owing chiefly to a large decrease in the mullet fishery, the State had fallen to the thirteenth position, being surpassed by Massachusetts, California, New Jersey, Maryland, New York, Virginia, Maine, Connecticut, Oregon, Washington, Rhode Island, and Florida. At the present time, owing to an almost phenomenal development of the oyster industry, the State occupies a place considerably in advance of that held in 1888, and probably ranks after Connecticut in the list before given. There is little reason to doubt that the increased attention recently devoted to oyster production and cultivation will soon give North Carolina higher rank and greater prestige as a fishing State.

GENERAL STATISTICS.

The statistical data herewith presented cover the entire commercial fishery interests of the State, including the river basins. From the three general tables which follow a clear conception may be gained of the condition and extent of the fisheries as they existed in 1889 and 1890.

The prominent features of the first table, showing the number of persons employed in the industry, are (1) the small proportion of vessel fishermen and the large number of shore and boat fishermen, the disparity being greater than in almost any other coast State; and (2) the substantial increase in the number of fishery employés in 1890 as compared with the previous year, the advance being especially marked in the shoresmen, the reasons for which will be brought out elsewhere. The total fishing population, numbering 10,274 in 1890, is much larger than that of any State, except Maryland, Massachusetts, Maine, Virginia, and New Jersey.

The capital invested in the fishing industry was $968,600 in 1889 and $1,243,988 in 1890. This increase was chiefly due to the greater amount of shore property and cash capital employed. In 1890 the value of vessels and their outfits was $101,029; of boats, pile-drivers, and steam flats, $188,375; of apparatus of capture, $344,278; of shore property and working capital, $610,306. The minor factors in the investment are brought out in the second table of the series.

In the third table the quantities and values of each of the important objects of capture are shown for 1889 and 1890. It is seen that in 1889 45,545,643 pounds of fishery products were taken, which yielded the fishermen $950,427, and in the following year 51,799,142 pounds were taken, with a value of $1,027,669. The most important single product of the North Carolina fisheries is the shad, the value of which in 1890 was $306,015; this sum was considerably in excess of the selling price of the next important species, the oyster, which was $175,567. The alewives had a value of $164,636, after which the principal species were mullet, worth $97,408; squeteague, worth $48,856; bluefish, worth $33,603; and striped bass, worth $32,138. The other products are relatively unimportant.

10.—Table of persons employed.

How engaged.	1889.	1890.
In vessel fisheries	233	251
On transporting vessels	110	175
In shore fisheries	6,837	7,052
On shore, in fish-houses, factories, etc	1,475	2,796
Total	8,655	10,274

11.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	47	$27,215	54	$30,550
Tonnage	473.79		530.72	
Outfit		11,127		12,129
Vessels transporting	51	23,950	74	53,000
Tonnage	536.16		1,084.87	
Outfit		3,575		5,350
Boats	3,747	162,544	3,816	162,905
Steam flats	20	24,000	20	24,000
Pontoons or pile-drivers	24	1,325	26	1,470
Apparatus of capture—vessel fisheries:				
Seines	12	3,775	16	3,975
Lines		2		2
Tongs	94	246	110	284
Apparatus of capture—shore fisheries:				
Seines	1,227	101,282	1,257	95,674
Pound nets	897	75,495	950	80,394
Gill nets	80,455	140,355	90,980	154,582
Fyke nets	33	355	36	384
Skim nets	731	2,788	728	2,798
Lines		43		55
Pots	290	450	1,165	1,755
Tongs, rakes, and forks	1,164	3,538	1,369	4,173
Miscellaneous apparatus		207		202
Shore property and accessories		237,128		306,506
Cash capital		149,200		303,800
Total		968,600		1,243,988

12.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	4,528,212	$43,602	5,219,979	$48,865
Alewives, salted	9,858,588	101,781	11,261,084	115,771
Black bass, fresh	419,170	21,092	406,330	20,420
Black bass, salted	1,000	60	1,200	72
Bluefish, fresh	712,611	16,983	1,151,380	29,398
Bluefish, salted	182,500	3,894	193,814	4,205
Catfish, fresh	55,220	1,248	53,685	1,246
Channel bass, fresh	141,400	1,427	136,950	1,404
Channel bass, salt.	130,868	1,279	28,865	515
Croakers, fresh	201,590	4,776	227,345	5,461
Croakers, salted	84,185	2,396	84,120	2,406
Eels, fresh	55,250	3,476	160,615	9,726
Flounders, fresh	48,200	872	48,630	894
Hogfish, fresh	206,899	6,296	251,370	7,830
Hogfish, salted	5,340	145	5,150	141
Menhaden, fresh	8,753,250	11,518	12,410,400	16,171
Mullet, fresh	654,463	12,927	974,815	19,178
Mullet, salted	2,398,017	72,018	2,610,216	78,065
Mullet roe, salted	825	140	950	165
Perch, fresh	558,417	21,366	583,204	22,098
Perch, salted	24,550	632	26,270	671
Pike, fresh	36,761	1,558	40,510	1,765
Pompano, fresh	8,200	656	9,750	780
Sea bass, fresh	28,900	939	33,075	1,158
Shad, fresh	5,263,986	276,037	5,675,063	301,942
Shad, salted	92,400	4,161	93,350	4,073
Sheepshead, fresh	77,172	3,104	90,665	4,000
Sheepshead, salted	55,015	1,966	55,680	1,981
Spanish mackerel, fresh	64,145	$4,866	82,950	$5,978
Spanish mackerel, salted	9,150	299	8,550	276
Spots, fresh	197,760	4,591	227,160	5,289
Spots, salted	161,870	4,209	181,100	5,573
Squeteague, fresh	1,443,465	35,456	1,640,160	39,958
Squeteague, salted	263,827	8,673	245,517	8,898
Strawberry bass, fresh	29,725	1,153	28,075	1,106
Striped bass, fresh	526,249	30,458	562,841	31,973
Striped bass, salted	5,100	153	5,500	165
Sturgeon, fresh	227,797	5,754	175,210	4,467
Suckers, fresh	58,146	1,745	60,550	1,779
Whiting, fresh	30,800	1,062	35,300	1,231
Other fish, fresh	436,818	11,935	474,452	12,851
Other fish, salted	77,680	2,101	87,963	2,362
Refuse fish	17,220	160	18,500	173
Porpoises	(*)	6,097	(*)	4,398
Shrimps	135,240	5,100	144,200	5,435
Crabs	50,000	1,250	47,400	1,185
Terrapins	26,750	4,703	26,552	4,690
Turtles	18,350	1,076	17,725	1,024
Quahogs	†155,472	8,265	†226,152	12,090
Scallops	‡15,750	700	‡18,000	800
Oysters	§7,011,340	194,272	§5,650,820	175,567
Total	45,545,643	950,427	51,799,142	1,027,669

* Number in 1889, 2,283; in 1890, 1,747.
† Weight of edible part; represents 19,434 bushels in 1889 and 28,269 bushels in 1890.
‡ Weight of edible part; represents 3,500 bushels in 1889 and 4,000 bushels in 1890.
§ Weight of edible part; represents 1,001,620 bushels in 1889 and 807,260 bushels in 1890.

9.—*Comparative statement of the values of the principal products of the fisheries of the South Atlantic States in 1880 and 1890.*

Products.	North Carolina.			South Carolina.		
	1880.	1890.	Increase or decrease.	1880.	1890.	Increase or decrease.
Fish:						
Alewives	$142,784	$164,636	+$21,852	$9,000	$740	—$8,260
Bluefish	12,000	33,603	+ 21,603	4,000	3,060	— 940
Mullet	80,500	97,408	+ 16,908	7,210	9,405	+ 2,195
Shad	329,569	306,015	— 23,554	12,432	41,187	+28,755
Squeteague	25,550	48,856	+ 23,306	10,300	3,604	— 6,696
Sturgeon	18,094	4,467	— 13,627	15,675	5,830	— 9,845
Others	145,823	167,495	+ 21,672	90,365	86,864	— 3,501
Total	754,320	822,480	+ 68,160	148,982	150,690	+ 1,708
Reptiles:						
Terrapins	10,850	4,690	— 6,160	1,950	8,376	+ 6,426
Turtles*		1,024	+ 1,024			
Total	10,850	5,714	— 5,136	1,950	8,376	+ 6,426
Crustaceans:						
Shrimps	4,500	5,435	+ 935	37,500	18,592	—18,908
Crabs	450	1,185	+ 735	750	1,740	+ 990
Total	4,950	6,620	+ 1,670	38,250	20,332	—17,918
Mollusks:						
Oysters	60,000	175,567	+115,567	20,000	23,204	+ 3,204
Clams	15,575	12,090	— 3,485	3,300		— 3,300
Scallops		800	+ 800			
Total	75,575	188,457	+112,882	23,300	23,204	— 96
Mammals:						
Porpoises		4,398	+ 4,398			
Grand total	845,695	1,027,669	+181,974	212,482	202,602	— 9,880

Products.	Georgia.			Florida.			Total		
	1880.	1890.	Increase or decrease.	1880.	1890.	Increase or decrease.	1880.	1890.	Increase or decrease.
Fish:									
Alewives	$3,750	$580	—$3,170	$200	$150	— $50	$155,734	$166,106	+$10,372
Bluefish	100		— 100	500	255	245	16,600	36,918	+ 20,318
Mullet	4,100	2,381	— 1,719	20,787	24,441	+ 3,654	112,597	133,635	+ 21,038
Shad	17,941	30,918	+12,977	20,136	104,283	+ 84,147	380,078	482,403	+102,325
Squeteague	2,280	7,911	+ 5,631	2,225	7,895	+ 5,670	40,355	68,266	+ 27,911
Sturgeon	24,780	1,937	—22,843	150	740	+ 590	58,699	12,974	— 45,725
Others	24,617	22,768	— 1,849	25,380	58,298	+ 32,918	286,185	335,425	+ 49,240
Total	77,568	66,495	—11,073	69,378	196,062	+126,684	1,050,248	1,235,727	+185,479
Reptiles:									
Terrapins	1,650	9,107	+ 7,457	200	1,425	+ 1,225	14,650	23,598	+ 8,948
Turtles*					4,441	+ 4,441		5,465	+ 5,465
Total	1,650	9,107	+ 7,457	200	5,866	+ 5,666	14,650	29,063	+ 14,413
Crustaceans:									
Shrimps	4,000	6,081	+ 2,081	3,500	2,557	— 943	$49,500	$32,665	—$16,835
Crabs	125	1,060	+ 935		185	+ 185	1,325	4,170	+ 2,845
Total	4,125	7,141	+ 3,016	3,500	2,742	— 758	50,825	36,835	— 13,990
Mollusks:									
Oysters	35,000	40,520	+ 5,520	5,000	14,850	+ 9,850	120,000	254,141	+134,141
Clams	1,650	300	— 1,350	330	350	+ 20	20,855	12,740	— 8,115
Scallops								800	+ 800
Total	36,650	40,820	+ 4,170	5,330	15,200	+ 9,870	140,855	267,681	+126,826
Mammals:									
Porpoises								4,398	+ 4,398
Grand total	119,993	123,563	+ 3,570	78,408	219,870	+141,462	1,256,578	1,573,704	+317,126

* Not reported in 1880, although probably taken. The comparison of the reptile catch is therefore unsatisfactory.

13.—Table showing by counties the number of persons employed in the fisheries of North Carolina in 1889 and 1890.

Counties.	On vessels fishing.		On vessels transporting.		In shore fisheries.		On shore, in factories, etc.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Currituck					490	558	20	21	510	579
Camden					36	38			36	38
Pasquotank			21	26	121	124	86	796	228	946
Perquimans					110	102	10	8	120	110
Chowan			18	17	506	488	307	309	831	814
Gates					8	10			8	10
Hertford					34	35			34	35
Bertie					348	234	89	71	437	305
Martin					126	126	16	16	142	142
Washington					136	133	66	67	202	200
Tyrrell					131	128	38	28	169	156
Dare			15	15	1,348	1,440	70	72	1,433	1,527
Hyde					143	156	7		150	156
Beaufort					98	135	13	607	111	742
Pitt					46	46			46	46
Edgecombe					103	113			103	113
Pamlico and Craven	51	51		16	863	917	560	614	1,474	1,598
Lenoir					27	27			27	27
Carteret	182	200	56	96	933	975	128	122	1,299	1,393
Onslow					504	524	55	55	559	579
New Hanover				5	274	286	10	10	284	301
Pender					111	113			111	113
Duplin					68	68			68	68
Sampson					125	126			125	126
Brunswick					148	150			148	150
Total	233	251	110	175	6,837	7,052	1,475	2,796	8,655	10,274

14.—Table showing by counties the apparatus and capital employed in the fisheries of North Carolina in 1889 and 1890.

Designation.	Currituck.				Camden.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	306	$11,860	271	$13,790	36	$4,870	37	$4,910
Apparatus of capture:								
Seines	191	5,520	216	5,595				
Pound nets	9	585	10	645				
Gill nets	7,700	13,550	9,250	15,838	2,038	3,008	2,060	3,040
Pots	145	230	420	640				
Shore property and accessories		1,320		1,515		710		725
Cash capital		2,500		2,500				
Total		35,565		40,523		8,588		8,675

Designation.	Pasquotank.				Perquimans.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting	9	$2,575	10	$5,475				
Tonnage	99.76		166.99					
Outfit		767		960				
Boats	33	2,493	33	2,493	33	$1,761	29	$1,538
Pontoons or pile-drivers					1	50	1	50
Apparatus of capture:								
Seines	5	620	5	620	2	2,000	2	2,000
Pound nets	10	1,700	10	1,725	86	6,850	65	5,200
Gill nets	2,625	3,844	2,650	3,957	1,170	1,641	1,210	1,772
Skim nets	25	63	25	63				
Shore properties and accessories		9,950		41,400		1,728		1,540
Cash capital		20,100		121,100		1,050		850
Total		42,112		177,793		15,080		12,950

12.—*Table showing by counties the apparatus and capital employed in North Carolina fisheries*—Continued.

Designation.	Chowan.				Gates.				Hertford.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting	8	$3,500	8	$3,400								
Tonnage	64.51		60.06									
Outfit		718		595								
Boats	131	5,743	123	5,520	6	$330	7	$405	14	$657	15	$678
Steam flats	8	8,800	8	8,800								
Pontoons or pile-drivers	13	750	14	825								
Apparatus of capture:												
Seines	9	19,800	8	18,800					5	750	5	775
Pound nets	466	36,305	485	37,768	16	1,800	22	2,100	8	840	9	950
Gill nets	19	275	24	325	85	110	75	95	100	135	110	143
Shore property and accessories		43,377		42,875		320		440		410		426
Cash capital		10,900		10,700								
Total		130,168		129,608		2,560		3,040		2,792		2,972

Designation.	Bertie.				Martin.				Washington.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	32	$1,565	25	$1,125	45	$745	45	$735	37	$2,400	36	$2,420
Steam flats	8	8,600	8	8,600								
Pontoons or pile-drivers									6	255	6	250
Apparatus of capture:												
Seines	10	19,600	7	12,600	4	2,600	4	2,600	4	3,000	4	3,000
Pound nets	27	1,600	28	1,659					107	8,705	109	8,855
Gill nets									471	771	486	793
Skim nets					30	90	30	90	181	952	193	1,006
Shore property and accessories		19,850		16,345		4,000		4,000		7,550		7,560
Cash capital		8,000		5,000		1,950		1,950		2,000		2,000
Total		59,215		45,329		9,385		9,375		25,633		25,884

Designation.	Tyrreli.				Dare.				Hyde.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting					7	$2,150	7	$2,125				
Tonnage					55.37		55.39					
Outfit						515		395				
Boats	57	$3,440	59	$3,650	1,147	75,780	1,184	72,071	98	$4,130	107	$4,485
Steam flats					4	6,600	4	6,600				
Pontoons or pile-drivers	1	120	1	120	3	150	4	225				
Apparatus of capture:												
Seines	1	500	1	500	238	13,045	246	13,983	91	2,026	87	1,900
Pound nets	102	8,560	115	9,535	38	4,450	54	6,182	4	600	8	1,200
Gill nets	2,850	4,387	3,230	5,106	48,975	75,298	56,396	85,947	2,214	3,047	2,570	3,955
Fyke nets					15	265	17	289				
Pots					120	180	650	975			30	45
Tongs, rakes, and forks					374	1,790	424	2,140	65	390	70	420
Minor apparatus		160		160								
Shore property and accessories		1,980		2,200		33,050		34,985		2,780		380
Cash capital		500		500		12,500		9,500		2,000		
Total		19,647		21,771		225,773		235,417		14,973		12,385

Designation.	Beaufort.				Pitt.				Edgecombe.			
	1889.		1890.		1880.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	49	$4,290	65	$5,920	35	$390	34	$399	87	$610	93	$690
Apparatus of capture:												
Seines	16	4,800	21	6,300	2	200	2	200	3	300	4	400
Pound nets	17	2,800	27	3,800	3	300	4	400	4	400	4	375
Gill nets	1,950	2,750	2,900	4,060								
Skim nets					30	150	28	140	80	400	85	420
Pots	25	40	65	95								
Shore property and accessories		9,430		50,905		110		130		139		160
Cash capital		10,800		67,300								
Total		34,910		138,380		1,150		1,269		1,849		2,045

14.—Table showing by counties the apparatus and capital employed in North Carolina fisheries—Continued.

Designation.	Pamlico and Craven.				Lenoir.				Carteret.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	13	$3,175	13	$3,175					34	$24,040	41	$27,375
Tonnage	103.47		103.47						370.32		427.25	
Outfit		2,450		2,450						8,677		9,679
Vessels transporting			5	9,750					27	15,725	42	30,050
Tonnage			185.47						316.52		575.78	
Outfit				595						1,575		2,585
Boats	407	9,571	434	9,982	9	$54	9	$54	704	24,177	701	23,977
Apparatus of capture—vessel fisheries:												
Seines									12	3,775	16	3,975
Lines										2		2
Tongs	38	100	38	100					56	146	72	184
Apparatus of capture—shore fisheries:												
Seines	64	6,650	69	6,900	9	450	9	450	427	11,660	416	11,120
Gill nets	4,300	7,800	4,066	6,457					5,148	11,779	5,148	11,779
Skim nets	320	960	300	900								
Tongs, rakes, and forks									585	1,036	680	1,173
Shore property and accessories		33,920		35,620		72		72		50,805		49,605
Cash capital		28,000		34,500						43,700		42,700
Total		92.626		110,429		576		576		197,097		214,204

Designation.	Onslow.				New Hanover.				Pender.			
	1889		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting							2	$2,200				
Tonnage							41.18					
Outfit								220				
Boats	285	$5,355	307	$5,602	65	$1,166	70	1,286	18	$290	18	$290
Apparatus of capture:												
Seines	37	2,760	38	2,775	31	1,350	34	1,490	18	810	18	810
Gill nets	629	7,574	642	7,060	130	3,514	114	3,250	17	555	15	620
Skim nets					20	60	22	66				
Lines		3		4		36		47				
Tongs, rakes, and forks	140	312	195	430		10		10				
Miscellaneous apparatus						47		42				
Shore property and accessories		6,070		6,030		8,940		8,940		90		90
Cash capital		2,700		2,700		2,500		2,500				
Total		24,774		24,601		17,623		20,051		1,745		1,810

Designation.	Duplin.				Sampson.				Brunswick.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	17	$85	17	$85	81	$404	81	$404	15	$378	16	$396
Apparatus of capture:												
Seines	17	561	17	561	28	615	28	615	15	1,665	16	1,680
Gill nets					25	25	25	25	9	292	9	360
Fyke nets					18	90	19	95				
Skim nets					45	113	45	113				
Lines						4		4				
Shore property and accessories		45		48		32		35		450		480
Total		691		694		1,283		1,291		2,785		2,916

15.—Table showing by counties and species the yield of the shore fisheries of North Carolina in 1889 and 1890.

Species.	Currituck.				Camden.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	6, 304	$63	4, 832	$48				
Alewives, salted	21, 500	242	23, 900	245				
Black bass, fresh	347, 170	17, 252	335, 000	16, 632				
Bluefish, fresh			132, 000	4, 100				
Channel bass, salted	8, 000	200	8, 200	205				
Eels, fresh	42, 400	2, 544	83, 500	5, 010				
Flounders, fresh	2, 300	92	2, 470	98				
Mullet, fresh	5, 600	208	6, 600	245				
Mullet, salted	24, 800	916	27, 220	994	3, 000	$120	3, 150	$126
Perch, fresh	120, 525	3, 622	125, 935	3, 785				
Perch, salted	3, 050	82	2, 820	75				
Pike, fresh	20, 161	953	24, 660	1, 168				
Shad, fresh	190, 400	10, 880	247, 671	14, 153	93, 100	3, 256	137, 813	5, 120
Sheepshead, salted	900	36	980	39				
Spots, fresh	2, 500	100	2, 380	95				
Strawberry bass, fresh	26, 625	998	24, 525	928				
Striped bass, fresh	3, 800	320	4, 240	350	2, 300	276	4, 200	462
Sturgeon, fresh	7, 800	225	8, 000	240				
Miscellaneous fish, salted	3, 500	70	3, 450	68				
Refuse fish	17, 220	160	18, 500	173				
Turtles	5, 100	306	5, 050	303				
Total	859, 655	39, 269	1, 091, 933	48, 954	98, 400	3, 652	145, 163	5, 708

Species.	Pasquotank.				Perquimans.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	57, 220	$725	60, 223	$751	694, 400	$6, 831	640, 560	$6, 269
Alewives, salted	79, 540	1, 157	85, 356	1, 249	61, 400	682	59, 940	660
Black bass, fresh	11, 300	578	13, 440	680				
Catfish, fresh	19, 420	583	21, 685	651				
Eels, fresh	7, 050	494	7, 200	504				
Perch, fresh	35, 775	2, 022	32, 270	1, 786	30, 700	1, 528	29, 050	1, 447
Pike, fresh	7, 100	355	7, 350	377				
Shad, fresh	120, 677	4, 533	132, 406	5, 248	106, 365	4, 694	97, 125	4, 295
Striped bass, fresh	3, 490	458	3, 174	357	4, 749	409	4, 000	316
Miscellaneous fish, fresh	675	33	820	41	3, 400	126	3, 230	112
Turtles	2, 250	135	2. 175	128				
Total	344, 497	11, 073	366, 099	11, 772	901, 014	14, 270	833, 905	13, 099

Species.	Chowan.				Gates.				Hertford.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds	Value.	Pounds	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	1, 824, 644	$16, 375	2, 258, 594	$19, 132	94, 000	$1, 175	84, 200	$1, 053	140, 614	$1, 731	152, 650	$1, 853
Alewives, salted	3, 841, 350	42, 831	4, 629, 284	50, 816					170, 848	2, 157	161, 234	2, 016
Perch, fresh	45, 514	1, 566	40, 520	1, 461	15, 200	456	15, 770	473	12, 616	439	10, 350	377
Shad, fresh	400, 141	22, 384	426, 726	23, 722	15, 050	860	16, 660	950	22, 240	1, 328	28, 525	1, 630
Shad, salted	16, 800	735	13, 725	526								
Striped bass, fresh	39, 450	2, 832	39, 450	2, 912	13, 500	1, 080	14, 200	1, 136	11, 296	877	8, 140	624
Sturgeon, fresh	28, 975	801	26, 110	731								
Other fish, fresh	55, 292	1, 776	59, 865	1, 892	1, 800	54	1, 800	54	3, 550	96	3, 440	98
Total	6, 252, 166	89, 300	7, 494, 274	101, 192	139, 550	3, 625	132, 630	3, 666	361, 164	6, 628	364, 339	6, 598

15.--Table showing by counties and species the yield of the shore fisheries of North Carolina—Continued.

Species.	Bertie.				Martin.				Washington.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	917,200	$8,736	941,000	$9,000	32,000	$312	36,800	$359	76,800	$768	82,000	$830
Alewives, salted	1,684,000	17,115	1,990,560	19,764	388,000	3,977	463,200	4,748	642,000	6,691	726,840	7,516
Mullet, salted									1,500	60	1,700	72
Perch, fresh	17,320	814	17,050	864					33,680	2,010	29,400	1,764
Shad, fresh	546,875	21,850	360,676	17,560	77,700	5,050	85,435	5,582	258,377	12,564	248,867	12,512
Shad, salted	16,800	960	13,125	750	6,300	216	7,000	247				
Striped bass, fresh	24,700	1,487	21,700	1,401	4,500	270	4,320	259	42,410	2,594	41,250	2,476
Sturgeon, fresh	6,152	62	5,715	60	11,450	115	10,060	100	73,720	2,539	68,200	2,336
Other fish, fresh	23,625	739	21,180	667	9,700	375	10,100	390	38,630	1,357	40,280	1,431
Total	3,236,672	51,763	3,371,006	50,066	529,650	10,315	616,915	11,685	1,167,117	28,583	1,238,537	28,937

Species.	Tyrrell.				Dare.				Hyde.			
	1889.		1890.		1889.		1890.		1889		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	52,000	$520	64,000	$624	91,200	$935	109,200	$1,119	31,010	$383	42,250	$540
Alewives, salted	1,169,920	11,648	1,210,800	12,188	1,432,400	10,744	1,488,400	11,327	63,630	769	100,590	1,248
Black bass, fresh					38,000	1,900	36,450	1,822				
Black bass, salted					1,000	60	1,200	72				
Bluefish, fresh					290,871	7,913	350,400	9,235	11,280	254	14,200	324
Bluefish, salted					74,600	1,514	70,200	1,458	72,760	1,677	79,300	1,847
Channel bass, fresh					87,900	887	88,050	890	22,500	240	21,800	235
Croakers, fresh					4,375	112	8,900	215	5,780	131	6,230	146
Croakers, salted					8,440	175	7,300	151	21,175	424	21,680	438
Eels, fresh					4,500	360	65,000	3,900			1,715	120
Mullet, fresh					136,825	2,891	149,580	3,135	13,510	203	12,800	192
Mullet, salted	8,500	340	8,800	352	305,800	9,023	286,375	8,514	69,180	1,297	63,800	1,199
Perch, fresh	54,075	1,886	51,780	1,805	32,200	884	36,350	1,050	44,500	1,405	66,465	1,995
Perch, salted					21,500	550	23,450	596				
Shad, fresh	99,680	4,272	114,975	5,188	2,030,760	110,073	2,358,121	131,723	69,475	3,573	97,230	4,970
Shad, salted					52,500	2,250	59,500	2,550				
Sheepshead, fresh					23,215	773	29,275	961	6,080	182	7,400	219
Sheepshead, salted					44,240	1,697	44,400	1,703	9,875	233	10,300	239
Spanish mackerel, fresh					3,245	162	5,950	298	2,500	113	3,000	140
Spanish mackerel, salted					2,650	84	2,950	90	4,500	135	4,000	122
Spots, fresh					10,160	229	14,650	312	4,250	94	5,300	114
Spots, salted					48,580	1,278	47,750	1,333	18,450	378	17,400	366
Squeteague, fresh					96,760	1,844	118,680	2,272	8,400	201	9,000	215
Squeteague, salted					79,460	1,417	79,930	1,525	46,700	1,031	41,340	914
Strawberry bass, fresh	1,000	50	1,120	56	2,100	105	2,430	122				
Striped bass, fresh	110,005	5,169	115,810	5,619	169,450	8,081	210,460	9,830	19,100	955	23,600	1,180
Striped bass, salted					5,100	153	5,500	165				
Other fish, fresh	2,600	78	3,200	96	31,620	847	36,470	925	10,300	246	12,455	295
Other fish, salted					15,980	314	14,400	293	28,200	564	30,880	628
Porpoises						5,200		1,737				993
Terrapins					3,600	425	3,450	405				
Turtles	7,500	460	6,800	408	2,500	175	3,700	185				
Quahogs					40,800	1,840	40,600	1,931	7,200	315	7,000	306
Oysters					3,167,500	71,350	2,057,125	58,775	504,350	8,480	537,950	12,600
Total	1,505,280	24,423	1,577,285	26,336	8,360,831	246,245	7,856,196	260,628	1,094,705	23,283	1,237,685	31,585

Species.	Beaufort.				Pitt.				Edgecombe.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	46,280	$595	55,100	$707	7,480	$94	8,400	$102	9,400	$117	11,080	$139
Alewives, salted	304,000	3,768	320,980	3,904								
Eels, fresh	1,300	78	3,200	192								
Perch, fresh	71,125	2,845	83,500	3,340	1,050	42	1,200	48	4,843	180	6,114	228
Shad, fresh	208,663	11,885	227,675	13,010	30,780	1,683	37,576	2,047	84,162	4,327	72,430	3,715
Striped bass, fresh	19,999	1,200	13,617	817								
Other fish, fresh	13,666	425	10,560	318	500	20	1,100	42	2,180	55	2,920	73
Total	665,033	20,806	714,632	22,378	39,810	1,839	48,276	2,239	100,585	4,679	92,544	4,155

15.—Table showing by counties and species the yield of the shore fisheries of North Carolina—Continued.

Species.	Pamlico and Craven.				Lenoir.				Carteret.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	443,660	$4,202	665,490	$6,303	4,000	$40	3,600	$36				
Black bass, fresh	22,700	1,362	21,440	1,286								
Bluefish, fresh									343,000	$6,860	579,200	$13,572
Bluefish, salted									34,000	680	43,000	860
Catfish, fresh	27,200	408	25,000	375								
Channel bass, fresh									10,200	80		
Channel bass, salted									104,200	800		
Croakers, fresh									96,365	1,927	109,915	2,198
Croakers, salted									49,500	1,665	49,050	1,656
Flounders, fresh	17,500	175	16,000	160								
Hogfish, fresh									37,450	999	41,400	1,092
Menhaden, fresh									195,000	245	201,000	251
Mullet, fresh									373,412	7,468	669,500	13,390
Mullet, salted									1,112,000	33,220	1,324,100	39,565
Perch, fresh	16,000	480	15,000	450								
Pike, fresh	9,500	250	8,500	220								
Pompano, fresh									5,000	400	6,000	480
Shad, fresh	507,500	29,000	594,348	29,318	24,500	1,400	29,988	1,574	26,500	1,060	23,000	920
Sheepshead, fresh									5,500	385	6,000	420
Spanish mackerel, fresh									55,700	4,456	70,500	5,355
Spanish mackerel, salted									2,000	80	1,600	64
Spots, fresh									107,650	2,153	124,250	2,485
Spots, salted									90,500	2,485	109,950	3,774
Squeteague, fresh	22,000	1,000	20,000	900					934,500	18,670	1,092,500	21,850
Squeteague, salted	14,250	427	14,500	435					7,500	150	6,000	120
Striped bass, fresh	57,500	4,450	54,680	4,234								
Sturgeon, fresh	26,000	260	25,500	255	1,200	12	1,000	10				
Other fish, fresh	56,000	810	58,872	840					21,600	812	37,000	940
Porpoises										897		1,668
Terrapins									18,000	3,328	18,432	3,360
Quahogs									72,272	4,477	108,152	6,720
Scallops									15,750	700	18,000	800
Oysters									2,465,890	76,912	1,986,250	57,575
Total	1,219,810	42,824	1,519,330	44,776	29,700	1,452	34,588	1,620	6,183,489	170,909	6,624,799	179,115

Species.	Duplin.				Sampson.				Brunswick.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Catfish, fresh					8,600	$257	7,000	$220				
Mullet, salted									127,500	$3,576	170,800	$4,614
Mullet roe, salted									825	140	950	165
Perch, fresh	1,800	$73	1,500	$61	15,294	866	15,450	926				
Shad, fresh	14,124	883	12,840	830	23,500	2,166	21,400	1,915	24,129	1,377	26,964	1,350
Suckers, fresh	22,800	513	25,180	566	20,046	888	20,550	879				
Other fish, fresh					1,900	45	2,300	52				
Terrapins									1,250	460	1,170	450
Oysters									12,600	900	12,005	900
Total	38,724	1,469	39,520	1,457	69,340	4,222	66,700	3,992	166,304	6,453	211,889	7,479

15.—Table showing by counties and species the yield of the shore fisheries of North Carolina—Continued.

Species.	Onslow.				New Hanover.				Pender.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish, fresh	6,800	$136	9,880	$187	45,360	$1,361	44,200	$1,326	15,300	$459	13,500	$454
Bluefish, salted	1,140	23	1,314	40								
Channel bass, fresh	2,000	20	2,800	28	18,800	200	24,300	251				
Channel bass, salted	18,668	279	20,665	310								
Croakers, fresh	18,400	400	22,100	473	62,170	1,771	67,450	1,996	14,500	435	12,750	433
Croakers, salted	5,070	132	6,090	161								
Flounders, fresh	2,000	40	1,930	37	15,900	355	20,730	449	10,500	210	7,500	150
Hogfish, fresh	30,500	675	35,000	758	121,099	4,086	154,970	5,380	17,850	536	20,000	600
Hogfish, salted	5,340	145	5,150	141								
Mullet, fresh	87,215	1,617	80,600	1,470	30,901	435	34,235	496	7,000	105	6,500	100
Mullet, salted	680,384	21,179	651,133	19,870	50,703	1,775	57,470	2,211	14,650	512	15,668	548
Perch, fresh									6,200	248	5,500	229
Pompano, fresh					3,200	256	3,750	300				
Sea bass, fresh					28,900	939	33,075	1,158				
Shad, fresh	25,179	1,431	22,172	1,110	152,869	8,742	149,800	7,500	111,240	6,756	104,640	6,000
Sheepshead, fresh					42,377	1,764	47,990	2,400				
Spanish mackerel, fresh					2,700	135	3,000	150				
Spots, fresh	9,500	190	12,000	240	63,700	1,825	68,580	2,043				
Spots, salted	4,340	68	6,000	100								
Squeteague, fresh	213,525	8,499	212,600	8,721	138,780	4,382	159,880	5,060	21,500	700	19,500	780
Squeteague, salted	115,917	5,648	103,747	5,904								
Sturgeon, fresh					72,500	1.740	30,625	735				
Suckers, fresh									15,300	344	14,820	334
Whiting, fresh					30,800	1,062	35,300	1,231				
Other fish, fresh	93,000	2,480	98,700	2,937	52,630	1,278	58,410	1,413	14,150	283	11,750	235
Other fish, salted	30,000	1,153	39,233	1,373								
Shrimps					135,240	5,100	144,200	5,435				
Crabs					50,000	1,250	47,400	1,185				
Terrapins	1,500	250	1,500	275	2,400	240	2,000	200				
Quahogs	20,000	1,000	24,000	1,200	15,200	633	46,400	1,933				
Oysters	206,500	12,450	339,500	17,600	35,000	2,750	37,009	2,830	7,000	550	7,497	565
Total	1,576,978	57,815	1,696,114	62,935	1,171,229	42,079	1,270,774	45,682	255,190	11,138	239,625	10,428

SUMMARY.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	4,528,212	$43,602	5,219,979	$48,865
Alewives, salted	9,858,588	101,781	11,261,084	115,771
Black bass, fresh	419,170	21,092	406,330	20,420
Black bass, salted	1,000	60	1,200	72
Bluefish, fresh	712,611	16,983	1,143,380	29,198
Bluefish, salted	182,500	3,894	193,814	4,205
Catfish, fresh	55,220	1.248	53,685	1,246
Channel bass, fresh	141,400	1.427	136,950	1,404
Channel bass, salted	130.868	1,279	28,865	515
Croakers, fresh	201,590	4.776	227,345	5,461
Croakers, salted	84,185	2,396	84,120	2,406
Eels, fresh	55,250	3,476	160,615	9,726
Flounders, fresh	48,200	872	48,630	894
Hogfish, fresh	206,899	6,296	251,370	7,830
Hogfish, salted	5,340	145	5,150	141
Menhaden, fresh	195,000	245	201,000	251
Mullet, fresh	654,463	12,927	959,815	19,028
Mullet, salted	2,398,017	72,018	2,610,216	78,065
Mullet roe, salted	825	140	950	165
Perch, fresh	556,417	21,366	583,204	22,098
Perch, salted	24.550	632	26,270	671
Pike, fresh	36,761	1,558	40,510	1,765
Pompano, fresh	8,200	656	9,750	780
Sea bass, fresh	28.900	939	33,075	1,158
Shad, fresh	5,263,986	276,027	5,675,063	301,942
Shad, salted	92,400	4,161	93,350	4,073
Sheepshead, fresh	77,172	3.104	90,665	4,000
Sheepshead, salted	55,015	1,966	55,680	1.981
Spanish mackerel, fresh	64,145	$4,866	82,450	$5,943
Spanish mackerel, salted	9,150	299	8,550	276
Spots, fresh	197,760	4,591	227,160	5,289
Spots, salted	161,870	4,209	181,100	5,573
Squeteague, fresh	1,435,465	35,296	1,632,160	39,798
Squeteague, salted	263,827	8,673	245,517	8,898
Strawberry bass, fresh	29,725	1,153	28,075	1,106
Striped bass, fresh	526,249	30,458	562,841	31,973
Striped bass, salted	5,100	153	5,500	165
Sturgeon, fresh	227,797	5,754	175,210	4,467
Suckers, fresh	58,146	1,745	60,550	1,779
Whiting, fresh	30,800	1,062	35,300	1,231
Miscellaneous fish, fresh	436,818	11,935	474,452	12,851
Miscellaneous fish, salted	77,680	2.101	87,963	2.362
Refuse fish	17,220	160	18,500	173
Porpoises		6,097		4.398
Shrimps	135,240	5,100	144,200	5.435
Crabs	50,000	1,250	47,400	1,185
Terrapins	26,750	4.703	26.552	4.690
Turtles	18,350	1,076	17,725	1.024
Quahogs	155,472	8,265	226,152	12.090
Scallops	15,750	700	18.000	800
Oysters	6,398,840	173,392	4.977.336	150,845
Total	36,366,893	918.114	38.884.758	986,482

16.—Table showing by counties and species the yield of the vessel fisheries of North Carolina in 1889 and 1890.

Species.	Craven.				Carteret.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bluefish							8,000	$200			8,000	$200
Menhaden					8.558,250	$11,273	12,209,400	15,920	8.558,250	$11,273	12,209,400	15,920
Mullet							15,000	150			15,000	150
Spanish mackerel							500	35			500	35
Squeteague					8,000	160	8,000	160	8,000	160	8,000	160
Oysters	210,000	$7,500	199.500	$7,125	402,500	13,380	473,984	17,597	612,500	20,880	673,484	24,722
Total	210,000	7,500	199,500	7,125	8,968,750	24,813	12,714,884	34.062	9,178,750	32,313	12,914,384	41,187

The shad is taken in every county and, as is already shown, is the most valuable fishery product of the State. The following table, giving the number of shad caught in each county during the two years covered by this report, may prove instructive. The great importance of the shad fisheries of Dare County is clearly brought out, the catch there being three-sevenths of that of the entire State. The yield in Pamlico and Craven, Chowan, and Bertie counties is also large, amounting to more than 100,000 fish in each.

17.—Table showing the number of shad taken in each county in North Carolina in 1889 and 1890.

Counties.	1889.	1890.	Counties.	1889.	1890.
Currituck	54,400	70,763	Pitt	8,794	10,736
Camden	26,600	39,375	Edgecombe	24,046	20,694
Pasquotank	34.479	37,830	Pamlico and Craven	145,000	148,000
Perquimans	30,390	27,750	Lenoir	7,000	7,497
Chowan	119,126	125.841	Carteret	7,571	5,750
Gates	4,300	4,760	Onslow	7,194	5,543
Hertford	6,354	8,150	New Hanover	43.677	37,700
Bertie	161,050	106,800	Pender	31,783	26,160
Martin	24.000	26,410	Duplin	4,035	3,210
Washington	73.822	71,105	Sampson	6,714	5,350
Tyrrell	28,480	32,850	Brunswick	6,894	6,741
Dare	595,217	690,749			
Hyde	19.850	27,780	Total	1,530,394	1,612,594
Beaufort	59.618	65,050			

THE FISHERIES CONSIDERED WITH REFERENCE TO THE APPARATUS USED.

A knowledge of the relative and actual effectiveness of the different forms of apparatus employed in the fisheries is of great practical advantage to the fishermen, and the following comprehensive table has been prepared with special reference to this fact. It shows, for each county, the quantity and value of each product taken with each kind of fishing device employed in the fisheries, and should be examined in connection with several preceding tables, in which the number and value of each form of apparatus are given.

It is seen that the seine is the form of apparatus that takes the largest quantities of fish and yields the greatest money returns. In 1889, 15,952,688 pounds of fish, valued at $349,269, were caught in this way, and in 1890, 17,984,830 pounds, worth $401,036. The fish secured in largest quantities are alewives, of which 8,177,340 pounds, valued at $82,031, were sold in 1889, and 9,152,799 pounds, worth $92,374, in 1890. The shad, however, is a more valuable fish than the alewives in the seine fisheries, and in 1890 was worth $98,457, although the value in 1889 was somewhat less than that of the alewives. The other prominent fish taken in seines are bluefish, mullet, squeteague, black bass, and spots, more of which are caught in seines than in any other form of apparatus.

The seine fisheries of the Albemarle section are more important than those of any other part of the State, and it is probable that the number of large shad seines there operated is greater than elsewhere in the United States. The counties bordering on the sound and its tributaries which maintain the most valuable seine fisheries are Chowan and Bertie. In that portion of Dare County bordering on Croatan Sound there are also important seine fisheries. In Pamlico Sound, Beaufort and Craven counties have valuable fisheries of this kind. Carteret County leads all others in the value of its seine fisheries, the sales of fish in 1890 amounting to $86,195; Dare, the next important county, followed with $52,111, after which came Bertie, Chowan, Craven, Currituck, Onslow, and Beaufort counties.

Next to the seine the pound net is the most productive means of capture, although the value of the catch is less than that of the gill nets. In 1889, 7,066,611 pounds of fish, valued at $111,877, were taken, and in 1890, 8,282,562 pounds, worth $123,606. By far the most important fish captured are the alewives, of which 6,073,160 pounds were secured in 1889, and 7,189,424 pounds in 1890. The next fish in point of value are shad, striped bass, and perch.

Few changes in the fisheries of the State during the past decade have been more remarkable than the large increase in the number of pound nets. In 1880 only 117 such nets were set in the State, while in 1890 there were 950. The pound nets are most numerous in the Albemarle region, but are also employed in the other sounds and the rivers emptying into them. This form of net was introduced into Albemarle Sound in 1870, since which time it has exerted a marked influence on the development of the fisheries by supplanting to a greater or less extent the older types of apparatus because of its greater cheapness and efficiency.

Gill nets take somewhat smaller quantities of fish than pound nets, but the catch has a greater value, owing chiefly to the large numbers of shad secured, which have a relatively high valuation. Considerably more than half the shad credited to the State are taken in gill nets, the catch in 1890 being 3,348,577 pounds, valued at $175,388. The yield of mullet and squeteague is also an important item in the gill-net fishery, the value of the former in 1890 being $27,054 and of the latter $16,186. No other species require special mention. Gill nets are most numerous in Dare County, in which the gill-net catch is far more valuable than in all the remaining counties combined, this prominence being due to the enormous quantities of shad taken. Carteret and Onslow counties rank next in importance, the principal part of the catch being marine species.

Of the remaining forms of apparatus used in the capture of fish, lines are the most prominent, although when compared with seines, pound nets, and gill nets they are insignificant. Line fishing on a commercial basis is followed only in Onslow, New Hanover, and Sampson counties, and the quantities of fish taken are small. The aggregate catch in 1890 was 380,375 pounds, having a value of $13,003, the principal species being hogfish and squeteague.

Skim nets are used in greatest numbers on the Roanoke and Tar rivers in the capture of shad and alewives. In 1890 247,148 pounds of fish, worth $10,581, were taken by this means. Eel pots are sparingly employed in four counties—Currituck, Dare, Hyde, and Beaufort—and their use appears to be increasing, especially in Dare County. Pots took 153,415 pounds of eels in 1890, for which the fishermen received $9,222.

Fyke nets are the only remaining apparatus used commercially in taking fish, and these are only sparingly employed in Dare and Sampson counties, where they catch small quantities of catfish, mullet, perch, suckers, sheepshead, striped bass, and squeteague. The total yield in 1890 was 24,885 pounds, valued at $716.

In the vessel fisheries, the yield of which has been given in a previous table, the variety of products taken and of apparatus used is too limited to require elaboration in a special table. The oysters were obtained with tongs, the menhaden with purse seines, the mullet and Spanish mackerel with haul seines, and the bluefish and squeteague with lines.

18.—Table showing by counties, apparatus, and species the yield of the shore fisheries of North Carolina in 1889 and 1890.

Apparatus and species.	Currituck.				Camden.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Alewives, fresh	6,304	$63	4,832	$48				
Black bass, fresh	336,520	16,826	323,200	16,160				
Bluefish, fresh			132,000	4,100				
Flounders, fresh	2,300	92	2,470	98				
Mullet, fresh	4,000	160	4,700	188				
Mullet, salted	1,600	64	1,720	69				
Perch, fresh	120,150	3,605	125,475	3,764				
Perch, salted	1,050	42	920	37				
Pike, fresh	19,261	913	23,560	1,119				
Spots, fresh	2,500	100	2,380	95				
Strawberry bass, fresh	26,175	978	24,000	904				
Refuse fish	17,220	160	18,500	173				
Total	537,080	23,003	663,757	26,755				
Pound nets:								
Alewives, salted	21,500	242	23,900	245				
Black bass, fresh	10,650	426	11,800	472				
Perch, fresh	375	17	460	21				
Pike, fresh	900	40	1,100	49				
Strawberry bass, fresh	450	20	525	24				
Total	33,875	745	37,785	811				
Gill nets:								
Channel bass, salted	8,000	200	8,200	295				
Mullet, fresh	1,600	48	1,900	57				
Mullet, salted	23,200	852	25,500	925	3,000	$120	3,150	$126
Perch, salted	2,000	40	1,900	38				
Shad, fresh	190,400	10,880	247,671	14,153	93,100	3,256	137,813	5,120
Sheepshead, salted	900	36	980	39				
Striped bass, fresh	3,800	320	4,240	350	2,300	276	4,200	462
Sturgeon, fresh	7,800	225	8,000	240				
Miscellaneous fish, salted	3,500	70	3,450	68				
Total	241,200	12,671	301,841	16,075	98,400	3,652	145,163	5,708
Pots:								
Eels	42,400	2,544	83,500	5,010				
Miscellaneous:								
Turtles	5,100	306	5,050	303				
Grand total	859,655	39,269	1,091,933	48,954	98,400	3,652	145,163	5,708

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

Apparatus and species.	Pasquotank.				Perquimans.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Alewives, fresh	14,560	$192	20,143	$250	370,800	$3,695	364,560	$3,661
Alewives, salted	17,440	262	26,856	397	41,200	505	40,640	491
Black bass, fresh	11,300	578	13,440	680	...	...	...	...
Catfish, fresh	12,000	360	14,000	420	...	...	...	...
Perch, fresh	28,375	1,430	26,700	1,341	700	28	550	22
Pike, fresh	7,100	355	7,350	377	...	...	...	...
Shad, fresh	2,800	150	3,063	168	45,500	1,950	42,210	1,809
Striped bass, fresh	900	110	1,100	121	1,000	80	800	62
Other fish, fresh	...	...	...	...	2,400	96	2,510	90
Total	94,475	3,437	112,652	3,754	461,600	6,354	451,270	6,135
Pound nets:								
Alewives, fresh	42,660	533	40,080	501	323,600	3,136	276,000	2,608
Alewives, salted	22,000	285	16,800	217	...	...	...	...
Catfish, fresh	7,420	223	7,685	231	...	...	...	...
Eels, fresh	7,050	494	7,200	504	...	...	...	...
Perch, fresh	7,400	592	5,570	445	30,000	1,500	28,500	1,425
Shad, fresh	5,331	300	5,198	292	25,900	1,375	18,620	1,034
Striped bass, fresh	1,790	268	834	116	2,700	270	1,835	180
Other fish, fresh	675	33	820	41	1,000	30	720	22
Total	94,326	2,728	84,187	2,347	383,200	6,311	325,675	5,269
Gill nets:								
Alewives, salted	13,600	212	14,300	225	20,200	177	19,300	169
Shad, fresh	112,546	4,083	124,145	4,788	34,965	1,369	36,295	1,452
Striped bass, fresh	800	80	1,240	120	1,049	59	1,365	74
Total	126,946	4,375	139,685	5,133	56,214	1,605	56,960	1,695
Skim nets:								
Alewives, salted	26,500	398	27,400	410	...	...	...	...
Miscellaneous:								
Turtles	2,250	135	2,175	128	...	...	...	...
Grand total	344,497	11,073	366,099	11,772	901,014	14,270	833,905	13,099

Apparatus and species.	Chowan.				Gates.				Hertford.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives, fresh	315,556	$3,549	354,666	$3,901	...	...	...	...	113,632	$1,394	120,926	$1,506
Alewives, salted	1,577,780	17,934	1,773,332	20,836	...	...	...	...	170,848	2,157	161,234	2,016
Perch, fresh	8,700	261	7,820	235	...	...	...	...	6,500	195	3,300	100
Shad, fresh	220,129	11,949	231,665	12,576	...	...	...	...	8,400	480	11,900	680
Shad, salted	10,500	525	6,900	276	...	...	...	...	...	...	...	...
Striped bass, fresh	13,950	792	12,200	732	...	...	...	...	5,100	408	2,500	200
Sturgeon, fresh	11,450	76	9,310	67	...	...	...	...	...	...	...	...
Other fish, fresh	26,400	792	28,150	845	...	...	...	...	1,450	34	1,200	30
Total	2,184,465	35,878	2,424,043	39,468	...	...	...	...	305,930	4,668	301,060	4,532
Pound nets:												
Alewives, fresh	1,509,088	12,826	1,903,928	15,231	94,000	$1,175	84,200	$1,053	26,982	337	31,724	347
Alewives, salted	2,263,570	24,897	2,855,952	29,980	...	...	...	...	...	...	...	...
Perch, fresh	36,814	1,305	32,700	1,226	12,500	375	9,270	278	3,016	151	3,250	162
Shad, fresh	173,082	10,079	187,635	10,722	9,100	520	8,050	460	8,940	568	11,025	630
Shad, salted	6,300	210	6,825	250	...	...	...	...	...	...	...	...
Striped bass, fresh	25,500	2,040	27,250	2,180	11,300	904	9,400	752	2,696	189	2,840	200
Other fish, fresh	28,892	984	31,715	1,047	1,200	36	1,600	48	1,400	42	1,620	50
Total	4,043,246	52,341	5,046,005	60,636	128,100	3,010	112,520	2,591	43,034	1,287	50,459	1,389
Gill nets:												
Perch, fresh	...	...	...	...	2,700	81	6,500	195	3,100	93	3,800	115
Shad, fresh	6,930	356	7,426	424	5,950	340	8,610	490	4,900	280	5,600	320
Striped bass, fresh	...	...	...	...	2,200	176	4,800	384	3,500	280	2,800	224
Sturgeon, fresh	17,525	725	16,800	664	...	...	...	...	...	...	...	...
Other fish, fresh	...	...	...	...	600	18	200	6	700	20	620	18
Total	24,455	1,081	24,226	1,088	11,450	615	20,110	1,075	12,200	673	12,820	677
Grand total	6,252,166	89,300	7,494,274	101,192	139,550	3,625	132,630	3,666	361,164	6,628	364,339	6,598

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

Apparatus and species.	Bertie.				Martin.				Washington.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives, fresh	796,000	$7,524	816,000	$7,752	32,000	$312	36,800	$359	30,000	$263	32,000	$280
Alewives, salted	1,660,000	16,845	1,961.760	19,414	388,000	3,977	463,200	4,748	210,000	1,942	232,000	2,146
Perch, fresh	7,520	226	5,300	159								
Shad, fresh	543,375	21,650	355,863	17,285	60.200	4,300	67,200	4,800	133,000	5,700	126,700	5,430
Shad, salted	16,800	960	13,125	750	6.300	216	7,000	247				
Striped bass, fresh	18,400	920	13,800	690	4,500	270	4,320	259	10.000	600	11,150	669
Sturgeon, fresh	6,152	62	5,715	60	11,450	115	10,060	100	12,500	125	12,100	122
Other fish, fresh	16.825	505	14.780	443	8,700	348	8,500	350	23,450	750	24,080	783
Total	3,065.072	48,692	3,186.343	46,553	511,150	9,538	597,080	10,863	418,950	9,380	438.030	9,430
Pound nets:												
Alewives, fresh	121,200	1.212	125,000	1,248					46,800	505	50,000	550
Alewives, salted	24,000	270	28,800	350					380,000	4,249	440.000	4,840
Perch, fresh	9,800	588	11,750	705					33,680	2,010	29,400	1,764
Shad, fresh	3,500	200	4.813	275					83,202	4,754	76,317	4,470
Striped bass, fresh	6,300	567	7,900	711					30,910	1,904	28,375	1,703
Sturgeon, fresh									1,720	34	1,500	30
Other fish, fresh	6,800	234	6,400	224					15,180	607	16,200	648
Total	171,600	3,071	184,663	3,513					591,492	14,063	641.792	14,005
Gill nets:												
Alewives, salted									8,000	60	7.440	56
Mullet, salted									1,500	60	1,700	72
Shad, fresh									25,200	1,140	27,650	1,312
Striped bass, fresh									1,500	90	1,725	104
Sturgeon, fresh									59,500	2,380	54,600	2,184
Total									95,700	3,730	93,115	3,728
Skim nets:												
Alewives, salted									44,000	440	47,400	474
Shad, fresh					17,500	750	18,235	782	16,975	970	18,200	1,300
Other fish, fresh					1,000	27	1,600	40				
Total					18,500	777	19,835	822	60,975	1,410	65,600	1,774
Grand total	3,236.672	51,763	3,371,006	50,066	529,650	10,315	616,915	11,685	1,167,117	28,583	1,238,537	28,937

Apparatus and species.	Tyrrell.				Dare.				Hyde.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:												
Alewives, salted	22,000	$165	21,000	$157	2,000	$25	2,000	$25				
Bluefish, fresh					19,000	437	30,000	755	5,180	$117	6,200	$144
Bluefish, salted					72,800	1,469	69,000	1,428	37,900	805	41,300	897
Channel bass, fresh					87,900	887	88.050	890	15,000	180	15,800	185
Croakers, fresh					3,275	82	5,100	128	3,000	68	3,230	78
Croakers, salted					7,820	156	6,800	136	12,800	256	10,780	220
Mullet, fresh					24,100	584	31,250	748	6,200	93	5,850	88
Mullet, salted	8,500	340	8.800	352	204,850	5.589	183,730	5,035	42,780	802	38,800	730
Perch, salted					15.000	350	16,100	372				
Shad, fresh	73,450	3,147	83,300	3,808	1,861.853	100,096	2,108,831	115,159	52,150	2,682	61,250	3,150
Shad, salted					52,500	2,250	59,500	2,550				
Sheepshead, fresh					7,590	276	9,000	315	4,100	113	5,200	142
Sheepshead, salt					6,890	241	8,000	280	6,350	127	6,900	137
Spanish mackerel, fresh					1,145	57	1,500	75	1,500	63	1,700	75
Spanish mackerel, salted					2,650	84	2,950	90	2,000	60	2,000	62
Spots, fresh					5,360	133	5,150	124	2,100	46	2,680	55
Spots, salted					25,300	505	22,250	443	10,500	210	9,400	206
Squeteague, fresh					7,860	237	15,300	460	3,600	81	3,750	84
Squeteague, salt					38,200	730	35,450	778	28,500	621	24,540	536
Striped bass, fresh	29,150	1.935	33,400	2,048	12,230	1,128	12,830	1,155	400	20	500	25
Striped bass, salt					5,100	153	5,500	165				
Other fish, fresh					1,870	37	2,000	40	5,130	110	6,130	135
Other fish, salted					15,460	304	14,100	287	14,700	294	15.000	310
Total	133,080	5,587	146,500	6.365	2,480,753	115,810	2,734,391	131,438	253,890	6,748	261,010	7,259

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

Apparatus and species.	Tyrrell.				Dare.				Hyde.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives, fresh									13,830	$168	16,750	$210
Alewives, salted	200,040	$2,004	202.200	$2,031	1,400,000	$10,400	1,450,000	$10,920	41,490	492	50,250	628
Black bass, fresh					38,000	1,900	36,450	1,822				
Black bass, salted					1,000	60	1,200	72				
Bluefish, fresh					264,271	7,158	296,600	7,955	6 100	137	8,000	180
Bluefish, salted					1,800	45	1,200	30	34,860	872	38,000	950
Channel bass, fresh									7,500	60	6,000	50
Croakers, fresh					1,100	30	1,500	45	2,780	63	3,000	68
Croakers, salted					620	19	500	15	8,375	168	10,900	218
Mullet, fresh					105,500	2,233	105,300	2,237	7,310	110	6,950	104
Mullet, salted					100,950	3,434	102,645	3,479	26,400	495	25,000	469
Perch, fresh	1,400	42	1,500	45	18,700	426	17,750	408	37,500	1,125	52,330	1,570
Perch, salted					6,500	200	7,350	224				
Shad, fresh	5,250	225	7,700	352	142,986	8,497	212,190	14,550	13,650	702	29,050	1,464
Sheepshead, fresh					14.600	454	16,950	530	1,980	69	2,200	77
Sheepshead, salt					37,350	1,456	36,400	1,423	3,525	106	3,400	102
Spanish mackerel, fresh					2,100	105	2,450	123	1,000	50	1,300	65
Spanish mackerel, salted									2,500	75	2,000	60
Spots, fresh					4,800	96	5.500	138	2,150	48	2,620	59
Spots, salted					23,280	773	25,500	890	7,950	168	8,000	160
Squeteague, fresh					52,200	870	46,520	795	4,800	120	5,250	131
Squeteague, salt					41,260	687	44,480	747	18,200	410	16,800	378
Strawberry bass, fresh					2,100	105	2,430	122				
Striped bass, fresh					77,800	2,522	96,700	3,135	18,700	935	23,100	1,155
Other fish, fresh	1,600	48	1,840	55	24,300	707	24,820	708	4,020	96	4,165	95
Other fish, salted					520	10	300	6	13,500	270	15,880	318
Porpoises						5,200		1,737				993
Total	208,290	2,319	213,240	2,483	2,361,737	47,387	2,534,735	52,111	278,120	6,739	330,945	9,504
Pound nets:												
Alewives, fresh	52,000	520	64,000	624	91,200	935	109,200	1,119	17,180	215	25.500	330
Alewives, salted	947,880	9,479	987,600	10,000	30,400	319	36,400	382	22,140	277	50,340	620
Bluefish, fresh					7,600	318	23,800	525				
Croakers, fresh							2,300	42				
Mullet, fresh					975	39	6,730	114				
Perch, fresh	52,675	1.844	50,280	1,760	13,500	458	18.600	651	7,000	280	14,135	425
Shad, fresh	21,000	900	23,975	1,028	25,921	1,480	37,100	2.014	3,675	189	6,930	356
Sheepshead, fresh					775	33	3,050	105				
Spanish mackerel, fresh							2,000	100				
Spots, fresh							4,000	50				
Squeteague, fresh					33,450	672	53,160	943				
Strawberry bass, fresh	1,000	50	1,120	56								
Striped bass, fresh	80,855	3,234	82,410	3,571	78,170	4,356	99,620	5,461				
Other fish, fresh	1,000	30	1,360	41	4,200	63	8,350	136	1,150	40	2.160	65
Total	1,156,410	16,057	1,210,745	17.080	286,191	8.673	404,310	11,642	51,145	1,001	99,065	1,796
Fyke nets:												
Mullet, fresh					6,250	35	6,300	36				
Sheepshead, fresh					250	10	275	11				
Squeteague, fresh					3,250	65	3,700	74				
Striped bass, fresh					1,250	75	1,310	79				
Other fish, fresh					1,250	40	1,300	41				
Total					12,250	225	12.885	241				
Pots:												
Eels					4,500	360	65,000	3,900			1,715	120
Miscellaneous:												
Terrapins					3,600	425	3,450	405				
Turtles	7,500	460	6,800	408	3.500	175	3,700	185				
Quahogs					40,800	1,840	40,600	1.931	7,200	315	7,000	306
Oysters					3,167,500	71,350	2,057,125	58,775	504.350	8.480	537,950	12,600
Total	7,500	460	6,800	408	3,215,400	73,790	2,104,875	61,296	511,550	8.795	544,950	12,906
Grand total	1,505,280	24,423	1.577,285	26,336	8,360,831	246,245	7,856,196	260,628	1,094,705	23,283	1,237,685	31,585

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

Apparatus and species.	Pamlico and Craven.				Lenoir.				Carteret.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives, fresh	443,660	$4,202	665,490	$6,303	4,000	$40	3,600	$36				
Black bass, fresh	9,500	570	8,000	480								
Bluefish, fresh									339,500	$6,790	576,500	$13,518
Catfish, fresh	27,200	408	25,000	375								
Channel bass, fresh									10,200	80		
Channel bass, salted									104,200	800		
Croakers, fresh									63,165	1,263	73,165	1,463
Flounders, fresh	17,500	175	16,000	160								
Hogfish, fresh									31,450	819	34,550	886
Mullet, fresh									20,000	400	25,000	500
Mullet, salted									1,044,000	31,320	1,247,000	37,410
Perch, fresh	9,500	285	9,000	270								
Pike, fresh	5,500	170	5,000	150								
Pompano, fresh									5,000	400	6,000	480
Shad, fresh	133,000	7,600	448,988	21,386	24,500	1,400	29,988	1,574				
Sheepshead, fresh									5,500	385	6,000	420
Spanish mackerel, fresh									48,800	3,904	61,000	4,880
Spots, fresh									63,350	1,267	75,500	1,510
Spots, salted									30,000	450	50,000	1,750
Squeteague, fresh	22,000	1,000	20,000	900					884,500	17,670	1,038,500	20,770
Squeteague, salt	14,250	427	14,500	435								
Striped bass, fresh	52,500	4,200	50,000	4,000								
Sturgeon, fresh	26,000	260	25,500	255	1,200	12	1,000	10				
Other fish, fresh	33,000	580	33,872	590					21,600	812	37,000	940
Porpoises										897		1,668
Total	793,610	19,877	1,321,350	35,304	29,700	1,452	34,588	1,620	2,671,265	67,257	3,230,215	86,195
Gill nets:												
Black bass, fresh	13200	792	13,440	806								
Bluefish, fresh									3,500	70	2,700	54
Bluefish, salted									34,000	680	43,000	860
Croakers, fresh									33,200	664	36,750	735
Croakers, salted									49,500	1,665	49,050	1,656
Hogfish, fresh									6,000	180	6,850	206
Menhaden, fresh									195,000	245	201,000	251
Mullet, fresh									353,412	7,068	644,500	12,890
Mullet, salted									68,000	1,900	77,100	2,155
Perch, fresh	6,500	195	6,000	180								
Pike, fresh	4,000	80	3,500	70								
Shad, fresh	329,000	18,800	105,360	5,632					26,500	1,060	23,000	920
Spanish mackerel, fresh									6,900	552	9,500	475
Spanish mackerel, salted									2,000	80	1,600	64
Spots, fresh									44,300	886	48,750	975
Spots, salted									60,500	2,035	59,950	2,024
Squeteague, fresh									50,000	1,000	54,000	1,080
Squeteague, salt									7,500	150	6,000	120
Striped bass, fresh	5,000	250	4,680	234								
Other fish, fresh	23,000	230	25,000	250								
Total	380,700	20,347	157,980	7,172					940,312	18,235	1,263,750	24,465
Skim nets:												
Shad, fresh	45,500	2,600	40,000	2,300								
Miscellaneous:												
Terrapins									18,000	3,328	18,432	3,360
Quahogs									72,272	4,477	108,152	6,720
Scallops									15,750	700	18,000	800
Oysters									2,465,890	76,912	1,986,250	57,575
Total									2,571,912	85,417	2,130,834	68,455
Grand total	1,219,810	42,824	1,519,330	44,776	29,700	1,452	34,588	1,620	6,813,489	170,909	6,624,799	179,115

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

Apparatus and species.	Onslow.				New Hanover.				Pender.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bluefish, fresh	6,800	$136	9,880	$187	15,650	$470	16,100	$483	15,300	$459	13,500	$454
Bluefish, salted	1,140	23	1,314	40								
Channel bass, fresh					18,800	200	24,300	251				
Croakers, fresh	6,400	160	8,100	193	41,800	1,254	45,040	1,419	14,500	435	12,750	433
Croakers, salted	1,070	32	1,420	45								
Flounders, fresh	2,000	40	1,930	37	10,500	210	13,910	278	10,500	210	7,500	150
Hogfish, fresh	13,000	325	15,600	370	52,842	1,585	59,070	1,772	17,850	536	20,000	600
Hogfish, salted	2,340	70	2,080	65								
Mullet, fresh	22,465	337	23,400	351	25,351	370	28,735	431	7,000	105	6,500	100
Mullet, salted	593,034	18,118	574,200	17,178	50,703	1,775	57,470	2,211	14,650	512	15,668	548
Perch, fresh									6,200	248	5,500	229
Pompano, fresh					3,200	256	3,750	300				
Shad, fresh									65,670	4,155	59,700	3,750
Sheepshead, fresh					38,027	1,546	42,120	2,106				
Spanish mackerel, fresh					2,700	135	3,000	150				
Spots, fresh					42,500	1,275	46,100	1,452				
Squeteague, fresh	20,150	500	22,480	542	57,450	1,724	69,430	2,083	21,500	700	19,500	780
Squeteague, salt	3,000	120	3,747	139								
Suckers, fresh									15,300	344	14,820	334
Other fish, fresh					25,750	515	29,680	594	14,150	283	11,750	235
Total	671,399	19,861	664,151	19,147	385,273	11,315	438,705	13,530	202,620	7,987	187,188	7,613
Gill nets:												
Channel bass, fresh	2,000	20	2,800	28								
Channel bass, salted	18,668	279	20,665	310								
Croakers, fresh	12,000	240	14,000	280	9,370	187	9,450	189				
Croakers, salted	4,000	100	4,670	116								
Hogfish, fresh	17,500	350	19,400	388	11,450	229	11,400	228				
Hogfish, salted	3,000	75	3,070	76								
Mullet, fresh	64,750	1,280	57,200	1,119	5,550	65	5,500	65				
Mullet, salted	87,350	3,061	76,933	2,692								
Shad, fresh	25,179	1,431	22,172	1,110	152,869	8,742	149,800	7,500	45,570	2,601	44,940	2,250
Spots, fresh	9,500	190	12,000	240	8,200	160	8,280	165				
Spots, salted	4,340	68	6,000	100								
Squeteague, fresh	169,375	7,359	150,020	7,111	12,550	251	12,600	252				
Squeteague, salt	112,917	5,528	100,000	5,765								
Sturgeon, fresh					72,500	1,740	30,625	735				
Other fish, fresh	90,000	2,400	93,400	2,802	2,880	43	2,930	45				
Other fish, salted	30,000	1,153	39,233	1,373								
Total	650,579	23,534	621,563	23,510	275,369	11,417	230,585	9,179	45,570	2,601	44,940	2,750
Lines:												
Bluefish, fresh					29,710	891	28,100	843				
Croakers, fresh					11,000	330	12,960	388				
Flounders, fresh					5,400	145	6,820	171				
Hogfish, fresh					56,807	2,272	84,500	3,380				
Sea bass, fresh					28,900	939	33,075	1,158				
Sheepshead, fresh					4,350	218	5,870	294				
Spots, fresh					13,000	390	14,200	426				
Squeteague, fresh	24,000	640	40,100	1,068	68,780	2,407	77,850	2,725				
Whiting, fresh					30,800	1,062	35,300	1,231				
Other fish, fresh	3,000	80	5,300	135	24,000	720	25,800	774				
Total	27,000	720	45,400	1,203	272,747	9,374	324,475	11,390				
Miscellaneous:												
Shrimps					135,240	5,100	144,200	5,435				
Crabs					50,000	1,250	47,400	1,185				
Terrapins	1,500	250	1,500	275	2,400	240	2,000	200				
Quahogs	20,000	1,000	24,000	1,200	15,200	633	46,400	1,933				
Oysters	206,500	12,450	339,500	17,600	35,000	2,750	37,009	2,830	7,000	550	7,497	565
Total	228,000	13,700	365,000	19,075	237,840	9,973	277,009	11,583	7,000	550	7,497	565
Grand total	1,576,978	57,815	1,696,114	62,935	1,171,229	42,079	1,270,774	45,682	255,190	11,138	239,625	10,428

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

Apparatus and species.	Beaufort.				Pitt.				Edgecombe.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Alewives, fresh	36,080	$460	44,060	$562	6,720	$84	7,000	$84	7,400	$92	8,480	$106
Alewives, salted	280,000	3,475	296,020	3,689								
Perch, fresh	50,625	2,025	64,250	2,570	250	10	900	36	2,743	96	3,314	116
Shad, fresh	135,600	7,720	151,200	8,640	8,400	465	5,618	305	14,914	767	9,429	485
Striped bass, fresh	17,916	1,075	12,917	775								
Other fish, fresh	8,335	265	6,000	180	500	20	1,100	42	1,280	32	1,920	48
Total	528,556	15,020	574,447	16,416	15,870	579	14,618	467	26,337	987	23,143	755
Pound nets:												
Alewives, fresh	10,200	135	11,040	145	760	10	1,400	18	2,000	25	2,600	33
Alewives, salted	24,000	293	24,960	305								
Perch, fresh	20,500	820	19,250	770	800	32	300	12	2,100	84	2,800	112
Shad, fresh	10,413	595	8,225	470	2,118	118	3,223	182	7,035	360	6,423	330
Other fish, fresh	3,166	95	4,135	125					900	23	1,000	25
Total	68,279	1,938	67,610	1,815	3,678	160	4,923	212	12,035	492	12,823	500
Gill nets:												
Shad, fresh	62,650	3,580	68,250	3,900								
Striped bass, fresh	2,083	125	700	42								
Other fish, fresh	2,165	65	425	13								
Total	66,898	3,770	69,375	3,955								
Skim nets:												
Shad, fresh					20,262	1,100	28,735	1,560	62,213	3,200	56,578	2,900
Pots:												
Eels	1,300	78	3,200	192								
Grand total	665,033	20,806	714,632	22,378	39,810	1,839	48,276	2,239	100,585	4,679	92,544	4,155

Apparatus and species.	Duplin.				Sampson.				Brunswick.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Mullet, salted									127,500	$3,576	170,800	$4,614
Mullet roe, salted									825	140	950	165
Perch, fresh	1,800	$73	1,500	$61	5,460	$383	4,450	$381				
Shad, fresh	14,124	883	12,840	830	13,700	1,286	12,400	1,100				
Suckers, fresh	22,800	513	25,180	566	14,980	685	15,150	684				
Total	38,724	1,469	39,520	1,457	34,140	2,354	32,000	2,165	128,325	3,716	171,750	4,779
Gill nets:												
Perch, fresh					1,000	50	1,000	50				
Shad, fresh									24,129	1,377	26,964	1,350
Suckers, fresh					1,200	48	1,400	55				
Other fish, fresh					900	25	800	22				
Total					3,100	123	3,200	127	24,129	1,377	26,964	1,350
Fyke nets:												
Catfish, fresh					3,800	112	3,000	90				
Perch, fresh					3,834	183	5,000	245				
Suckers, fresh					3,866	155	4,000	140				
Total					11,500	450	12,000	475				
Skim nets:												
Shad, fresh					9,800	880	9,000	815				
Lines:												
Catfish, fresh					4,800	145	4,000	130				
Perch, fresh					5,000	250	5,000	250				
Other fish, fresh					1,000	20	1,500	30				
Total					10,800	415	10,500	410				
Miscellaneous:												
Terrapins									1,250	460	1,170	450
Oysters									12,600	900	12,005	900
Total									13,850	1,360	13,175	1,350
Grand total	38,724	1,469	39,520	1,457	69,340	4,222	66,700	3,992	166,304	6,453	211,889	7,479

18.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of North Carolina—Continued.

SUMMARY.

Apparatus and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Seines:				
Alewives, fresh	2,190,542	$22,038	2,495,307	$25,058
Alewives, salted	5,986,798	59,993	6,657,492	67,316
Black bass, fresh	395,320	19,874	381,090	19,142
Black bass, salted	1,000	60	1,200	72
Bluefish, fresh	647,621	15,150	1,052,580	26,877
Bluefish, salted	37,800	940	40,514	1,020
Catfish, fresh	39,200	768	39,000	795
Channel bass, fresh	36,500	340	30,300	301
Channel bass, salted	104,200	800	....	....
Croakers, fresh	129,745	3,205	143,555	3,621
Croakers, salted	10,065	219	12,820	278
Flounders, fresh	42,800	727	41,810	723
Hogfish, fresh	115,142	3,265	129,220	3,628
Hogfish, salted	2,340	70	2,080	65
Mullet, fresh	191,626	3,715	200,585	3,911
Mullet, salted	1,958,837	59,294	2,194,503	65,978
Mullet roe, salted	825	140	950	165
Perch, fresh	306,123	10,458	329,639	11,307
Perch, salted	7,550	242	8,270	261
Pike, fresh	31,861	1,438	35,910	1,646
Pompano, fresh	8,200	656	9,750	780
Shad, fresh	1,585,198	79,879	1,817,704	97,184
Shad, salted	33,600	1,701	27,025	1,273
Sheepshead, fresh	60,107	2,454	67,270	3,133
Sheepshead, salted	40,875	1,562	39,800	1,525
Spanish mackerel, fresh	54,600	4,194	67,750	5,218
Spanish mackerel, salted	2,500	75	2,000	60
Spots, fresh	115,300	2,786	132,100	3,254
Spots, salted	61,230	1,391	83,500	2,800
Squeteague, fresh	1,062,600	22,584	1,221,680	26,001
Squeteague, salted	76,710	1,644	79,527	1,699
Strawberry bass, fresh	28,275	1,083	26,430	1,026
Striped bass, fresh	220,766	11,912	228,587	11,798
Sturgeon, fresh	68,752	650	63,685	614
Suckers, fresh	53,080	1,542	55,150	1,584
Other fish, fresh	213,760	5,883	231,367	6,028
Other fish, salted	14,020	280	16,180	324
Refuse fish	17,220	160	18,500	173
Porpoises	....	6,097	....	4,398
Total	15,952,688	349,269	17,984,830	401,036
Pound nets:				
Alewives, fresh	2,337,670	21,564	2,724,672	23,807
Alewives, salted	3,735,490	40,311	4,464,752	46,939
Black bass, fresh	10,650	426	11,800	472
Bluefish, fresh	7,600	318	23,800	525
Catfish, fresh	7,420	223	7,685	231
Croakers, fresh	....	....	2,300	42
Eels, fresh	7,050	494	7,200	504
Mullet, fresh	975	39	6,730	114
Perch, fresh	230,160	10,056	226,265	9,756
Pike, fresh	900	40	1,100	49
Shad, fresh	379,217	21,438	397,534	22,263
Shad, salted	6,300	210	6,825	250
Sheepshead, fresh	775	33	3,050	105
Spanish mackerel, fresh	....	....	2,000	100
Spots, fresh	....	....	4,000	50
Squeteague, fresh	33,450	672	53,160	943
Strawberry bass, fresh	1,450	70	1,645	80
Striped bass, fresh	240,221	13,732	260,464	14,874
Sturgeon, fresh	1,720	34	1,500	30
Other fish, fresh	65,563	2,217	76,080	2,472
Total	7,066,611	111,877	8,282,562	123,606
Gill nets:				
Alewives, salted	65,800	639	64,040	632
Black bass, fresh	13,200	792	13,440	806
Bluefish, fresh	27,680	624	38,900	953
Bluefish, salted	144,700	2,954	153,300	3,185
Channel bass, fresh	104,900	1,087	106,650	1,103
Channel bass, salted	26,668	479	28,865	515
Gill nets—Cont'd.				
Croakers, fresh	60,845	$1,241	68,530	$1,410
Croakers, salted	74,120	2,177	71,300	2,128
Hogfish, fresh	34,950	759	37,650	822
Hogfish, salted	3,000	75	3,070	76
Menhaden, fresh	195,000	245	201,000	251
Mullet, fresh	455,612	9,138	746,200	14,967
Mullet, salted	439,180	12,724	415,713	12,087
Perch, fresh	13,300	419	17,300	540
Perch, salted	17,000	390	18,000	410
Pike, fresh	4,000	80	3,500	70
Shad, fresh	3,127,321	165,220	3,289,077	172,838
Shad, salted	52,500	2,250	59,500	2,550
Sheepshead, fresh	11,690	389	14,200	457
Sheepshead, salted	14,140	404	15,880	456
Spanish mackerel, fresh	9,545	672	12,700	625
Spanish mackerel, salted	6,650	224	6,550	216
Spots, fresh	69,460	1,415	76,860	1,559
Spots, salted	100,640	2,818	97,600	2,773
Squeteague, fresh	243,385	8,928	235,670	8,987
Squeteague, salted	187,117	7,029	165,990	7,199
Striped bass, fresh	64,012	4,739	72,480	5,222
Striped bass, salted	5,100	153	5,500	165
Sturgeon, fresh	157,325	5,070	110,025	3,823
Suckers, fresh	1,200	48	1,400	55
Other fish, fresh	127,245	2,948	131,505	3,331
Other fish, salted	63,660	1,821	71,783	2,038
Total	5,920,945	237,951	6,354,178	252,249
Fyke nets:				
Catfish, fresh	3,800	112	3,000	90
Mullet, fresh	6,250	35	6,300	36
Perch, fresh	3,834	183	5,000	245
Sheepshead, fresh	250	10	275	11
Squeteague, fresh	3,250	65	3,700	74
Striped bass, fresh	1,250	75	1,310	79
Suckers, fresh	3,866	155	4,000	140
Other fish, fresh	1,250	40	1,300	41
Total	23,750	675	24,885	716
Skim nets:				
Alewives, salted	70,500	838	74,800	884
Shad, fresh	172,250	9,500	170,748	9,657
Other fish, fresh	1,000	27	1,600	40
Total	243,750	10,365	247,148	10,581
Lines:				
Bluefish, fresh	29,710	891	28,100	843
Catfish, fresh	4,800	145	4,000	130
Croakers, fresh	11,000	330	12,960	388
Flounders, fresh	5,400	145	6,820	171
Hogfish, fresh	56,807	2,272	84,500	3,380
Perch, fresh	5,000	250	5,000	250
Sea bass, fresh	28,900	939	33,075	1,158
Sheepshead, fresh	4,350	218	5,870	294
Spots, fresh	13,000	390	14,200	426
Squeteague, fresh	92,780	3,047	117,950	3,793
Whiting, fresh	30,800	1,062	35,300	1,231
Other fish, fresh	28,000	820	32,600	939
Total	310,547	10,509	380,375	13,003
Pots:				
Eels	48,200	2,982	153,415	9,222
Miscellaneous:				
Shrimps	135,240	5,100	144,200	5,435
Crabs	50,000	1,250	47,400	1,185
Terrapins	26,750	4,703	26,552	4,690
Turtles	18,350	1,076	17,725	1,024
Quahogs	155,472	8,265	226,152	12,090
Scallops	15,750	700	18,000	800
Oysters	6,398,840	173,392	4,977,336	150,845
Total	6,800,402	194,486	5,457,365	176,069
Grand total	36,366,893	918,114	38,884,758	986,482

THE SHORE FISHING INDUSTRIES.

The shore enterprises of North Carolina dependent on the fisheries are of great interest and importance, and their development is, in many cases, a true index of the condition of the fisheries with which they are connected. The branches to which attention may be directed are the porpoise industry, the menhaden industry, the wholesale fish trade, the oyster-canning industry, and the wholesale oyster trade. The prominent features of each of these is shown in the following tables, which are presented in a condensed form in order to avoid that disclosure of private interests which would, in many instances, ensue if the counties were specified.

The porpoise industry.—The porpoise industry and the fishery which it supports are of less extent than formerly, owing to the diminished inducements offered to the fishermen by the low prices received for the raw products. In 1889 and 1890 only two firms were engaged in handling the porpoises, in preparing their hides, and in trying out their oil. The number of porpoises killed was 2,283 in 1889, and 1,747 in 1890, for which the fishermen received $6,097 and $4,398, respectively. The resulting manufactured products were valued at $13,757 in 1889, and $10,350 in 1890.

The menhaden industry.—North Carolina is the most southern State in which the menhaden fishery and industry are carried on. The fishery is the only one, except that for oysters, in which vessels are employed, and it is the only offshore vessel fishery in the State, although a considerable part of the fish handled are caught in the sounds adjacent to the ocean and not in the ocean itself. The business is centered at or in the vicinity of Beaufort, where seven factories were in operation in 1889 and six in 1890. The capital invested in the latter year in buildings, vessels, apparatus, etc., was $97,560; the number of persons employed was 187; the value of the fish handled was $16,171; and the value of the manufactured products was $38,727.

The wholesale fish trade.—The business of buying fish from the fishermen and shipping the catch to market engaged the attention of 23 wholesale firms in 1889 and 1890. These handled in 1889 4,501,387 pounds of fresh and salt fish, and 67,200 pounds of mollusks and reptiles, for which $141,931 was paid to the fishermen; and in 1890 5,571,790 pounds of fresh and salt fish and 63,650 pounds of reptiles, etc., the cost price of which was $166,074. The selling price of the products was $219,903 and $257,120, respectively, so that the gross profits of the trade were $77,972 in 1889 and $91,046 in 1890.

The oyster industry.—The canning of oysters in North Carolina is a business which has sprung up within the past few years and become of considerable importance in two counties—Pasquotank and Beaufort. In 1889 only two firms engaged in the industry, but in 1890 the number had increased to five. The 1,362 persons employed in the latter year received $83,450 in wages. The quantity of oysters bought was 375,500 bushels in 1889 and 861,262 bushels in 1890, for which $121,425 and $290,232, respectively, were paid. The oysters were put up in 2,101,320 one-pound and two-pound cans worth $207,358 in 1889, and 4,886,112 cans worth $477,189 in 1890.

The oyster-packing trade in 1890 was engaged in by twelve firms located in Pasquotank and Washington counties. Nearly half a million bushels of oysters were utilized for opening, for which the fishermen received $170,989; the shell oysters yielded 326,630 gallons, the market value of which was $340,361.

19.—Table showing the extent of the porpoise industry of North Carolina in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	2	2
Number of fishermen and shoresmen	81	79
Value of property	$3,300	$3,300
Cash capital	$4,000	$4,000
Porpoises handled ... number	2,283	1,747
Value paid	$6,097	$4,398
Value as sold	$12,758	$9,726
Oil manufactured ... gallons	3,897	2,746
Value	$999	$624
Enhancement in value	$7,660	$5,952

20.—Table showing the extent of the menhaden industry of North Carolina in 1889 and 1890.

Designation.	1889.	1890.
Number of factories in operation	7	6
Value of factories	$39,800	$38,800
Cash capital	$23,500	$22,500
Number of shoresmen employed	80	74
Number of fishermen employed	118	113
Number of steam vessels employed	1	1
Net tonnage	44.15	44.15
Value	$8,500	$8,500
Value of outfit	$1,800	2,550
Number of sailing vessels employed	10	10
Net tonnage	140.92	149.89
Value	$6,790	$9,250
Value of outfit	$6,250	$6,990
Number of vessels employed as "carryaways"	8	9
Net tonnage	113.73	128.03
Value	$6,900	$8,350
Value of outfit	$515	620
Number of menhaden handled	14,588,750	20,684,000
Value to fishermen	$11,518	$16,171
Number of gallons of oil prepared	36,304	50,369
Value as sold	$7,155	$11,153
Number of tons of scrap prepared	923	1,375
Value as sold	$18,760	$27,574

21.—Table showing the extent of the wholesale fish trade of North Carolina in 1889 and 1890.

Designation.	1889.	1890.
Number of firms	23	23
Number of persons employed	107	109
Value of property	$38,300	$38,775
Cash capital	$40,680	$42,000
Wages paid	$13,881	$15,245
Fresh fish handled ... pounds	3,837,487	4,478,990
Value paid	$113,957	$127,953
Salted fish handled ... pounds	663,900	1,092,800
Value paid	$18,902	$30,072
Mollusks and reptiles handled ... pounds	67,200	63,650
Value paid	$9,072	$8,049
Value of products as sold	$219,903	$257,120
Enhancement in value	$77,972	$91,046

22.—Table showing the extent of the oyster industry of North Carolina.

Designation.	Oyster-canning industry.		Oyster-packing trade, 1890.
	1889.	1890.	
Number of firms	2	5	12
Number of persons employed	681	1,362	623
Value of property	$29,150	$66,600	$34,850
Cash capital	$45,000	$108,000	$94,500
Wages paid	$31,874	$83,450	$64,096
Oysters handled ... bushels	375,500	861,262	492,250
Value paid	$121,425	$290,232	$170,989
Prepared products:			
One-pound cans ... number	1,599,408	3,855,984	....
Two-pound cans ... do	501,912	1,030,128	....
Value received	$207,358	$477,189	....
Shucked oysters ... gallons	....	....	326,630
Value received	....	....	$340,361
Enhancement in value	$85,933	$186,957	$169,372

III.—FISHERIES OF SOUTH CAROLINA.

The coastal region of South Carolina consists for the most part of a belt of swampy land from 5 to 30 miles in width, which is intersected by numerous creeks, rivers, and channels, forming innumerable large and small islands. The generally even outline of the shore is broken by Winyah Bay, Bull Bay, Charleston Harbor, St. Helena Sound, Port Royal Sound, and some other minor indentations. The principal rivers emptying directly into the ocean or into the bodies of water mentioned are the Pedee, Santee, Combahee, and Savannah, all of which have commercial fisheries. Charleston, Beaufort, and Georgetown are the principal cities on the coast and are the centers of the most important fisheries.

THE FISHING-GROUNDS.

The waters in and adjacent to the swampy belt abound in fish, crustaceans, terrapins, and oysters, and are favorite spawning-grounds for many species. The boat and shore fisheries are chiefly prosecuted in this region. The following account of the offshore grounds resorted to by the smack and boat fishermen of Charleston and other places on the coast of the State will bear repetition in this report:

> Cape Romain Bank is a small rocky patch, about half a mile square, situated 8 miles SSE. from Cape Romain light and 4 miles S. by W. from the outer shoal buoy. It has a depth of 8 fathoms, the bottom consisting of lime rock and gravel with willow corals (gorgonians) growing upon it. Fish are caught on this ground from June to October, the following varieties being taken, namely: Sea bass, porgies, grunts, bluefish, sharks, a few sailor's choice, and in October spotted bass, which often weigh from 30 to 40 pounds each.
>
> Inner East Bank bears SE. from Charleston light-ship; distance, 8 miles. It extends 1 mile east and west and one-half mile north and south, and has a depth of 7½ fathoms. It is frequented by smacks and small boats, the smacks going there from June to December and the small boats only from June to September. The fishing is done with hooks and lines, and the following kinds of fish are caught: Blackfish, porgies, jacks (abundant), and flounders.
>
> Outer East Bank bears SE. by E. from Charleston light-ship; distance, 11 miles. It extends 1 mile east and one-half mile north and south, and has 8½ to 10 fathoms of water upon it, the bottom consisting of coral rock and yellow sand. The same smacks and boats fish on this bank that visit the Inner East Bank, the season being the same and also the species of fish taken.
>
> Eastern Hole bears SE. by E. 15 miles from Charleston light. It is about a mile in diameter, with a depth of 12 fathoms, and a bottom of lime rock, sand, and willow corals. It is fished on, by smacks only, from October to April. Sea bass are the fish chiefly caught in the daytime, but at night tomcod, butter-fish, tautog, and a few flounders are also taken.
>
> Outer Southeast Ground bears SE. 27½ miles from Charleston light, and extends 5 miles east and west and 2 miles north and south. The bottom is mostly coral rock, with many purple willow corals (gorgonians). The south side of the ground is covered with large red shells, the east side with bright white sand and white sand mixed with black specks, the west side with shells and sand. The smacks fish here from November to April and May, the catch consisting of sea bass, bastard snappers, red snappers, and jacks.
>
> Inner Southeast Bank bears SE. 10 miles from Charleston light, and extends 2½ miles east and west and 1½ miles north and south. It has about 10 fathoms of water and a coral bottom. This is a summer fishing-ground, and small boats and smacks visit it from May until August. Porgies, blackfish, redmouth grunts, black grunts, tautog, sailor's choice, and cobias are taken. Porgies school here abundantly in August, and about 300 is considered a fair day's catch. These weigh from three-fourths of a pound to 1 pound each, and are tied in bunches of five each for sale. The average daily catch of blackfish is 250, of grunts 300; but only a few tautog, black grunts, and sailor's choice are taken. Cobias come in May and remain until July; they drive all other fish away from these grounds. The average daily catch of this species to a man is three.

Coffin Land Ground or Inner Ground bears SSE. 8 miles from Charleston light, and is 3 miles long east and west by 2½ miles wide north and south. The bottom is of coral rock, and the depth 7 to 9 fathoms. Smacks and boats fish on this ground with hooks and lines (the only method pursued on these grounds) principally from April to December. Jacks are caught from April to August, porgies from July to October, and blackfish and sea bass from the first of October to the first of December. The average daily catch to a man, of all kinds, is about 400 fish.

Old Farms Ground bears SSE. 18 miles from Charleston light, is 5 miles long east and west by 3 miles wide north and south, and has a depth of 12 to 17 fathoms, with a bottom of coral and broken shells. This is a winter fishing-ground, and only smacks resort to it. Sea bass, red snappers, and bastard snappers are the principal fish taken from October to April; but, besides these, a few tautog, black grunts, and redmouth grunts are caught. The bait used on this and other grounds in the vicinity is blackfish, shark, and squid. The blackfish is the best. The daily catch of fish to a man is about three hundred.

Outer Old Farms Ground bears SSE. 25 miles from Charleston light, and is 3 miles long east and west by 1½ miles wide north and south. The bottom is of coral rock with "willows," and the depth 17 fathoms. This is also a winter ground for the same kinds of fish that are caught on the Old Farms, and fishing is carried on from October to April.

Inner South Ground bears S. ½ E. from Charleston light; distance, 15 miles. Its length is 1½ miles east and west and its width one-half mile north and south. It has 12 fathoms of water, and an uneven bottom of coral rock and yellow "willows." This is a winter ground, resorted to by smacks only from December until April. Blackfish, bastard snappers, red snappers, black grunts, porgies, and occasionally sharks, nursefish, and squirrel-fish are taken. Bastard snappers are the most plentiful, while the other kinds are generally scarce.

Outer South Ground bears S. ½ E. 27½ miles from Charleston light, and extends 2 miles east and west and three-fourths of a mile north and south. The depth of water is 14½ fathoms, and the bottom consists of coral rock, yellow "willows," and sponges. It is a winter ground, fished on from December to April. The same kinds of fish occur upon it as upon the Inner South Ground.

Edisto Bank bears SE. by S. 11 miles from Edisto Harbor. It is 1 mile long east and west by one-fourth of a mile wide, and has a depth of 8 to 10 fathoms. The bottom consists of rocks and shells, and on the north side of red sand. Smacks fish here from April to October. The fish taken are sea bass, porgies, redmouth grunts, a few jacks, and occasionally a cobia. Sharks (puppy sharks) are so plentiful in June as to stop fishing.

Blank Ground bears SE. ½ S. 8 or 9 miles from Outer South Ground, and extends 4 or 5 miles east and west and 2 miles north and south. It has 14 fathoms of water, and the bottom consists mostly of "willows," with some other corals. Fishing is best in January.

Tybee Ground bears E. ½ N. 12 to 14 miles from Martin's Industry light-ship. It is 1½ miles long southeast and northwest, and one-half mile wide. The bottom consists of shells and corals, the depth being 9 to 9½ fathoms. This ground is resorted to by the smacks, from August to January, for blackfish and trout, which are taken to the Charleston market, 50 miles distant.*

GENERAL IMPORTANCE AND NATURE OF THE FISHERIES.

Taking the value of the products of the fisheries as a basis, South Carolina ranks third among the States of this region, being surpassed by North Carolina and eastern Florida. The State occupied the same relative rank in 1880. In the number of persons engaged, South Carolina is in advance of Florida, owing to the relatively large semi-professional fishing population in the river fisheries. Compared with 1880, the results of the present canvass show an increase in persons and property and a decrease in the quantity and value of the catch. An analysis of the returns indicates that the decline has been chiefly in the shrimp, sturgeon, and alewife fisheries, while an advance is to be noted in the yield of terrapin and shad. The most important fishery of this State is that for shad, after which, in order of their value, are the fisheries for sea bass or blackfish, oysters, whiting, and shrimp.

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* The Fisheries and Fishery Industries of the United States. <Section III, The Fishing Grounds of North America. Pp. 53–55.

The principal opportunities for the development of the fisheries of the State probably lie in the oyster-grounds and the facilities offered for their cultivation. A recent examination of the coastal waters of this State by the U. S. Fish Commission with reference to their availability for oyster-culture demonstrated the fact that the natural oyster beds are being depleted and that recourse must be had to artificial methods if the supply is to be maintained. The natural grounds surveyed occupied less than 800 acres, but there are probably 15,000 or 20,000 acres of bottom now destitute of oysters that are suitable for planting purposes. Those persons who are interested in the subject should consult the report* in which the results of the survey are given.

GENERAL NOTES AND STATISTICS.

Three tables follow, in which the condensed statistics of the fisheries of this State are shown for the years 1889 and 1890.

From Table 23 it is seen that in the latter year the fisheries gave employment to 2,701 persons, of whom 74 were employed in the vessel fisheries, 2,503 in the shore or boat fisheries, and 124 in the shore branches of the industry.

The aggregate capital invested in the business, as indicated in Table 24, was $127,762, of which $29,325 represented vessels and their outfits, $31,804 boats, $22,108 apparatus, and $44,525 shore property and working capital.

Table 25 gives the quantity and value of each product of the fisheries. The total yield in 1890 was 4,944,840 pounds, valued at $202,602, of which more than half was represented by four species, viz, shad, sea bass, oysters, and whiting. Besides these, shrimp, terrapin, and mullet are of importance.

23.—Table of persons employed.

How engaged.	1889.	1890.
In vessel fishery	73	67
On transporting vessels		7
In shore fisheries	2,527	2,503
On shore, in fish-houses, etc	42	124
Total	2,642	2,701

24.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	14	$13,300	13	$14,800
Tonnage	222.39		217.38	
Outfit		4,450		3,925
Vessels transporting			2	10,000
Tonnage			22.66	
Outfit				600
Boats	1,234	31,147	1,227	31,804
Apparatus of capture—vessel fisheries:				
Lines		152		143
Apparatus of capture—shore fisheries:				
Seines	71	3,875	74	4,008
Gill nets	1,551	17,030	1,380	13.958
Miscellaneous nets	753	2,638	734	2,464
Lines		452		419
Tongs	146	1,036	169	1,116
Shore property		20,125		27,525
Cash capital		13,000		17,000
Total		107,205		127,762

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*An investigation of the coast waters of South Carolina with reference to oyster-culture. Bulletin U. S. Fish Commission, 1890, pp. 303-330, 7 maps.

25.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	37,160	$939	28,600	$740
Black bass, fresh	1,995	100	2,100	107
Bluefish, fresh	110,060	3,300	100,480	3,060
Bream and perch, fresh	103,233	5,139	104,635	5,204
Catfish, fresh	132,163	4,618	129,051	4,523
Channel bass, fresh	90,870	3,077	88,410	2,986
Drum, fresh	170,305	2,095	184,618	2,340
Hickory shad, fresh	42,918	1,467	34,237	1,226
Mullet, fresh	104,400	1,810	58,000	1,650
Mullet, salted	240,000	8,400	329,875	7,755
Sea bass, fresh	886,274	28,362	826,164	26,283
Shad, fresh	577,457	42,696	563,259	41,187
Sheepshead, fresh	38,640	1,265	39,100	1,256
Snappers, fresh			18,500	553
Spots and croakers, fresh	46,050	1,596	41,670	1,450
Squeteague, fresh	116,113	4,129	103,106	3,604
Striped bass, fresh	10,785	1,010	11,560	1,084
Sturgeon, fresh	271,980	3,071	203,962	3,850
Suckers, fresh	48,593	2,257	49,872	2,277
Whiting, fresh	491,382	19,768	523,520	20,930
Miscellaneous fish, fresh	502,702	16,430	509,886	16,645
Shrimps	380,400	19,020	371,840	18,592
Crabs	86,230	1,362	93,260	1,740
Terrapins	71,325	7,071	74,948	8,376
Oysters	*305,340	19,890	†442,050	23,204
Caviare	12,750	1,509	12,137	1,980
Total	4,879,125	200,381	4,944,840	202,602

* 43,620 bushels. † 63,150 bushels.

CONSIDERATION OF THE FISHERIES BY COUNTIES.

There are six counties of this State that abut immediately on the coast, all of which support commercial fisheries. There are nine others on the Savannah, Edisto, and Pedee rivers that have fisheries entitled to consideration as being of an economic nature. The extent of the fisheries in each county is shown in the three following tables, which relate to persons engaged, capital invested, and products. The figures for Charleston and Berkeley counties are combined, owing to their close connections, which made it difficult to satisfactorily separate the statistics.

26.—Table showing by counties the number of persons employed in the fisheries of South Carolina in 1889 and 1890.

Counties.	On fishing vessels.		On transporting vessels.		In shore fisheries.		On shore, in fish-houses, etc.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Chesterfield					47	50			47	50
Marlboro					43	45			43	45
Marion					225	221			225	221
Darlington					30	32			30	32
Florence					111	106			111	106
Williamsburg					83	84			83	84
Georgetown and Horry					719	671	10	12	729	683
Orangeburg					133	126			133	126
Berkeley and Charleston	73	67		7	687	731	28	106	788	911
Colleton					110	111			110	111
Aiken					23	21			23	21
Barnwell					75	70			75	70
Hampton					30	25			30	25
Beaufort					211	210	4	6	215	216
Total	73	67		7	2,527	2,503	42	124	2,642	2,701

27.—Table showing by counties the apparatus and capital employed in the fisheries of South Carolina in 1889 and 1890.

Designation.	Chesterfield.				Marlboro.				Marion.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	18	$106	20	$114	18	$103	19	$105	165	$825	163	$815
Apparatus of capture:												
Seines	3	162	3	162	2	108	2	108	......	......	......	......
Gill nets	......	......	......	......	......	......	......	......	150	450	155	464
Miscellaneous nets	34	159	36	163	15	75	7	35	115	296	110	293
Lines	......	5	......	5	......	4	......	5	......	25	......	26
Total	......	432	......	444	......	290	......	253	......	1,596	......	1,598

Designation.	Darlington.				Florence.				Williamsburg.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	13	$72	14	$78	81	$387	78	$381	50	$225	49	$220
Apparatus of capture:												
Seines	4	215	4	215	......	......	......	......	......	......	......	......
Gill nets	1	6	1	6	......	......	......	......	......	......	......	......
Miscellaneous nets	6	20	7	22	72	188	68	182	48	134	47	131
Lines	......	5	......	5	......	11	......	11	......	6	......	6
Total	......	318	......	326	......	586	......	574	......	365	......	357

Designation.	Georgetown and Horry.				Orangeburg.				Berkeley and Charleston.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing	......	......	......	......	......	......	......	......	14	$13,300	13	$14,800
Tonnage	......	......	......	......	......	......	......	......	222.39	......	217.38	......
Outfit	......	......	......	......	......	......	......	......	......	4,450	......	3,925
Vessels transporting	......	......	......	......	......	......	......	......	......	......	2	10,000
Tonnage	......	......	......	......	......	......	......	......	......	......	22.66	......
Outfit	......	......	......	......	......	......	......	......	......	......	......	600
Boats	326	$8,148	283	$7,711	36	$109	34	$101	287	18,529	331	19,660
Apparatus of capture—vessel fisheries:												
Lines	......	......	......	......	......	......	......	......	......	152	......	143
Apparatus of capture—shore fisheries:												
Seines	12	1,400	12	1,335	3	120	3	120	28	1,090	29	1,120
Gill nets	433	13,745	368	10,031	465	233	448	224	46	1,440	60	1,982
Miscellaneous nets	109	468	119	376	98	245	94	236	51	306	50	300
Lines	......	15	......	16	....	2	....	2	......	280	......	240
Tongs	10	50	10	48	....	200	....	200	60	400	78	457
Shore property	......	3,000	......	3,000	....	......	....	......	......	15,600	......	22,600
Cash capital	......	3,000	......	3,000	....	......	....	......	......	10,000	......	14,000
Total	......	29,826	......	25,517	....	909	....	883	......	65,547	......	89,827

Designation.	Colleton.				Aiken.				Barnwell.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	57	$686	61	$823	11	$75	10	$69	26	$104	23	$92
Apparatus of capture:												
Seines	12	480	13	540	......	......	......	......	......	......	......	......
Gill nets	217	539	217	608	15	130	11	123	208	124	101	70
Miscellaneous nets	21	43	16	38	12	22	10	21	65	171	63	164
Lines	......	9	......	8	......	29	......	27	......	23	......	25
Tongs	6	36	6	36	......	......	......	......	......	......	......	......
Shore property	......	1,125	......	1,175	......	......	......	......	......	......	......	......
Total	......	2,918	......	3,228	......	256	......	240	......	422	......	351

27.—Table showing by counties the apparatus and capital employed in South Carolina fisheries—Continued.

Designation.	Hampton.				Beaufort.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing									14	$13. 300	13	$14. 800
Tonnage									222. 39		217. 38	
Outfit										4. 450		3. 925
Vessels transporting											2	10, 000
Tonnage											22. 66	
Outfit												600
Boats	14	$138	15	$145	132	$1, 640	127	$1, 490	1, 234	31, 147	1, 227	31, 804
Apparatus of capture—vessel fisheries:												
Lines										152		143
Apparatus of capture—shore fisheries:												
Seines					7	300	8	408	71	3, 875	74	4, 008
Gill nets	14	333	15	340	2	30	4	110	1, 551	17, 030	1, 380	13, 958
Miscellaneous nets	7	11	9	13	100	500	98	490	753	2, 638	734	2. 464
Lines		15		18		23		25		452		419
Tongs					70	350	75	375	146	1, 036	169	1, 116
Shore property		200		250		200		500		20, 125		27, 525
Cash capital										13, 000		17, 000
Total		697		766		3, 043		3, 398		107, 205		127, 762

28.—Table showing by counties and species the yield of the fisheries of South Carolina in 1889 and 1890.

Species.	Chesterfield.				Marlborough.				Marion.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh									16, 200	$405	12, 300	$310
Bream and perch, fresh	8, 830	$428	8, 580	$415	12, 000	$585	12, 240	$594	20, 915	976	20, 800	959
Catfish, fresh	8, 668	259	8, 412	252	11, 849	356	11, 075	332	14, 680	464	15, 600	495
Hickory shad, fresh	682	33	733	36	455	22	489	24				
Shad, fresh	9, 194	1, 078	11, 753	1, 165	3, 410	350	2, 600	265	15, 860	1, 219	16, 021	1, 386
Sturgeon, fresh	1, 067	32	910	27	711	21	607	18				
Suckers, fresh	11, 869	485	12, 097	494	662	33	698	35	3, 500	150	3, 945	158
Miscellaneous fish, fresh	6, 176	247	5, 870	238	9, 557	383	8, 783	351	11, 585	463	12, 750	486
Total	46, 486	2, 562	48, 355	2, 622	38, 644	1, 750	36, 492	1, 619	82, 740	3, 677	81, 416	3, 794

Species.	Darlington.				Florence.				Williamsburg.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives					9, 720	$243	7, 380	$186	3, 240	$81	2, 460	$62
Bream and perch, fresh	7, 785	$378	7, 650	$371	9, 560	464	9, 780	475	2, 870	140	3, 060	148
Catfish, fresh	8, 378	251	8, 240	248	8, 600	258	8, 200	246	2, 718	82	2, 600	78
Hickory shad, fresh	911	44	978	50								
Shad, fresh	5, 744	515	5, 336	526	14, 446	1, 110	12, 178	934	11, 982	890	11, 657	877
Sturgeon, fresh	1, 422	42	1, 245	37								
Suckers, fresh	1, 325	66	1, 395	70								
Miscellaneous fish, fresh	5, 369	217	5, 037	202	5, 630	225	5, 800	232	1, 925	77	1, 840	74
Total	30, 934	1, 513	29, 881	1, 504	47, 956	2, 300	43, 338	2, 073	22, 735	1, 270	21, 617	1, 239

Species.	Colleton.				Aiken.				Barnwell.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and perch, fresh	9, 280	$622	10, 010	$662					3, 600	$180	3, 440	$172
Catfish, fresh	2, 500	50	2, 890	60	13, 273	$742	13, 580	$743	10, 027	600	8, 960	560
Hickory shad, fresh	2, 516	118	2, 761	138								
Shad, fresh	25, 183	1, 982	30, 638	2, 618	2, 639	414	2, 366	376	4, 563	485	4, 004	430
Striped bass, fresh	3, 085	300	2, 880	280								
Sturgeon, fresh	27. 300	535	45, 500	1, 365	9, 520	136	8, 400	120				
Suckers, fresh	1, 375	83	1, 260	76					7, 330	370	7, 226	360
Miscellaneous fish, fresh	6, 500	484	11, 740	694	2, 120	135	2, 040	135				
Oysters	7, 840	840	8, 750	938								
Caviare	2, 375	285	1, 562	250								
Total	87, 954	5, 299	117, 991	7, 081	27, 552	1, 427	26, 386	1, 374	25. 520	1, 635	23, 630	1, 522

28.—Table showing by counties and species the yield of the fisheries of South Carolina in 1889 and 1890—Cont'd.

Species.	Georgetown and Horry.				Orangeburg.				Berkeley and Charleston.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh	8,000	$210	6,460	$182								
Black bass, fresh	1,995	100	2,100	107								
Bluefish, fresh									110,060	$3,300	100,480	$3,060
Bream and perch, fresh	14,737	651	14,610	656	8,250	$444	7,900	$441				
Catfish, fresh	13,070	436	11,700	396					12,850	380	15,064	450
Channel bass, fresh	8,420	420	6,060	360					76,350	2,287	77,540	2,326
Drum, fresh									15,305	450	19,618	590
Hickory shad, fresh	33,182	995	24,108	720	512	24	568	28	4,660	231	4,600	230
Mullet, fresh	8,400	210	18,000	450					96,000	1,600	40,000	1,200
Mullet, salted	240,000	8,400	329,875	7,755								
Sea bass, fresh									878,974	28,131	819,964	26,088
Shad, fresh	338,433	24,825	325,819	23,044	10,091	928	9,193	848	113,525	7,185	111,150	6,840
Sheepshead, fresh									33,640	1,005	35,580	1,067
Snappers, fresh											18,500	553
Spots and croakers, fresh									38,620	1,184	34,280	1,040
Squeteague, fresh	10,715	640	8,306	480					87,678	2,629	80,710	2,418
Striped bass, fresh	3,000	240	2,800	224	700	70	620	60	4,000	400	5,260	520
Sturgeon, fresh	198,800	1,420	112,000	1,280					4,860	150	4,500	145
Suckers, fresh	7,440	310	8,423	340	15,092	760	14,828	744				
Whiting, fresh									450,862	18,060	493,750	19,750
Miscellaneous fish, fresh	23,685	948	22,510	887	1,355	108	1,705	137	414,440	12,408	419,516	12,540
Shrimps									360,400	18,020	359,840	17,992
Crabs	1,020	42	1,200	45					83,350	1,250	90,060	1,620
Terrapins	3,000	250	3,600	350					51,075	5,221	51,525	5,725
Oysters	17,500	1,000	18,200	1,300					161,000	13,800	241,500	14,766
Caviare	9,375	1,104	8,750	1,505								
Total	940,022	42,201	923,621	40,081	36,000	2,334	34,814	2,258	2,997,649	117,691	3,023,437	118,920

Species.	Hampton.				Beaufort.				Total for the State.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives, fresh									37,160	$939	28,600	$740
Black bass, fresh									1,995	100	2,100	107
Bluefish, fresh									110,060	3,300	100,480	3,060
Bream and perch, fresh	5,406	$271	6,565	$311					103,233	5,139	104,635	5,204
Catfish, fresh	25,550	740	22,730	663					132,163	4,618	129,051	4,523
Channel bass, fresh					6,100	$370	4,810	$300	90,870	3,077	88,410	2,986
Drum, fresh					155,000	1,645	165,000	1,750	170,305	2,095	184,618	2,340
Hickory shad, fresh									42,918	1,467	34,237	1,226
Mullet, fresh									104,400	1,810	58,000	1,650
Mullet, salted									240,000	8,400	329,875	7,755
Sea bass, fresh					7,300	231	6,200	195	886,274	28,362	826,164	26,283
Shad, fresh	18,187	1,475	16,484	1,646	4,200	240	4,060	232	577,457	42,696	563,259	41,187
Sheepshead, fresh					5,000	260	3,520	189	38,640	1,265	39,100	1,256
Snappers, fresh											18,500	553
Spots and croakers, fresh					7,430	412	7,390	410	46,050	1,596	41,670	1,450
Squeteague, fresh					17,720	860	14,090	706	116,113	4,129	103,106	3,604
Striped bass, fresh									10,785	1,010	11,560	1,084
Sturgeon, fresh	28,300	735	28,000	788			2,800	70	271,980	3,071	203,962	3,850
Suckers, fresh									48,593	2,257	49,872	2,277
Whiting, fresh					40,520	1,708	29,770	1,180	491,382	19,768	523,520	20,930
Miscellaneous fish, fresh	760	45	1,330	80	13,600	690	10,965	594	502,702	16,430	509,886	16,645
Shrimps					20,000	1,000	12,000	600	380,400	19,020	371,840	18,592
Crabs					1,860	70	2,000	75	86,230	1,362	93,260	1,740
Terrapins					18,000	1,600	20,723	2,301	71,325	7,071	74,948	8,376
Oysters					119,000	4,250	173,600	6,200	305,340	19,890	442,050	23,204
Caviare	1,000	120	1,200	200			625	25	12,750	1,509	12,137	1,980
Total	79,203	3,386	76,309	3,688	415,730	13,336	457,553	14,827	4,879,125	200,381	4,944,840	202,602

PRODUCTS WITH REFERENCE TO THE APPARATUS USED.

The quantity and value of the products of the fisheries taken by means of lines are much greater than those taken by any other form of apparatus, amounting in 1890 to 2,448,043 pounds, worth $79,485. The most prominent fish captured are sea bass and whiting. Next to lines in importance are gill nets, the yield of which was 781,593 pounds, valued at $40,494, of which $30,051 represented shad. The catch in seines was 537,853 pounds and sold for $17,050, more than half of which represented mullet. Such miscellaneous types of nets as skim nets, cast nets, dip nets, etc., took 183,116 pounds, valued at $11,681, consisting chiefly of shad. The details of this phase of the industry are given by counties in Table 29, which relates to the shore fisheries.

Although the vessel fisheries of South Carolina rank second in value among those of the States of this region, they are relatively and actually unimportant when compared with the shore or boat fisheries. Vessels are employed only in Charleston County and engage only in line fishing on the banks off Charleston. Sea bass and snappers are the species taken. In 1889 the catch amounted to 528,911 pounds, worth $17,631, and in 1890 to 538,278 pounds, valued at $17,641.

29.—Table showing by counties, apparatus, and species the yield of the shore fisheries of South Carolina in 1889 and 1890.

Apparatus and species.	Chesterfield.				Marlboro.				Marion.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Catfish, fresh	1,378	$41	1,012	$30	919	$28	675	$20				
Hickory shad, fresh	682	33	733	36	455	22	489	24				
Shad, fresh	3,393	384	3,108	280								
Sturgeon, fresh	1,067	32	910	27	711	21	607	18				
Suckers, fresh	994	50	1,047	32	662	33	698	35				
Other fish, fresh	446	20	260	10	297	13	173	7				
Total	7,960	560	7,070	435	3,044	117	2,642	104				
Gill nets:												
Bream and perch, fresh									3,050	$120	3,300	$130
Suckers, fresh									3,500	150	3,945	158
Other fish, fresh									1,950	78	2,750	86
Total									8,500	348	9,995	374
Miscellaneous nets:												
Alewives, fresh									16,290	405	12,300	310
Shad, fresh	5,801	694	8,645	885	3,410	350	2,600	265	15,800	1,219	16,021	1,386
Suckers, fresh	10,875	435	11,050	442								
Other fish, fresh	420	15	370	13	2,125	85	1,250	50				
Total	17,096	1,144	20,065	1,340	5,535	435	3,850	315	32,090	1,624	28,321	1,696
Lines:												
Bream and perch, fresh	8,820	428	8,580	415	12,000	365	12,240	394	17,865	858	17,500	829
Catfish, fresh	7,290	218	7,400	222	10,950	528	10,440	312	14,680	464	15,600	495
Other fish, fresh	5,310	212	5,240	210	7,135	285	7,320	294	9,635	384	12,000	400
Total	21,420	858	21,220	847	30,085	1,178	30,000	1,000	42,180	1,706	45,100	1,724
Grand total	46,476	2,562	48,355	2,622	38,644	1,730	36,492	1,619	82,770	3,677	83,416	3,794

29.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of South Carolina—Continued.

Apparatus and species.	Darlington.				Florence.				Williamsburg.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Catfish, fresh	1,838	$55	1,340	$41								
Hickory shad, fresh	911	44	978	50								
Shad, fresh	4,525	405	4,143	374								
Sturgeon, fresh	1,422	42	1,245	37								
Suckers, fresh	1,325	66	1,395	70								
Other fish, fresh	594	26	347	13								
Total	10,615	638	9,448	585								
Gill nets:												
Shad, fresh	244	23	260	80								
Miscellaneous nets:												
Alewives, fresh					9,720	$243	7,380	$186	3,240	$81	2,460	$62
Catfish, fresh	300	9	400	12								
Shad, fresh	975	87	933	72	14,446	1,110	12,178	934	11,982	890	11,657	877
Other fish, fresh	60	3	90	5								
Total	1,335	99	1,423	89	24,166	1,353	19,558	1,120	15,222	971	14,117	939
Lines:												
Bream and perch, fresh	7,785	378	7,650	371	9,560	464	9,780	475	2,870	140	3,060	148
Catfish, fresh	6,240	187	6,500	195	8,600	258	8,200	246	2,718	82	2,600	78
Other fish, fresh	4,715	188	4,600	184	5,630	225	5,800	232	1,925	77	1,840	74
Total	18,740	753	18,750	750	23,790	947	23,780	953	7,513	299	7,500	300
Grand total	30,934	1,513	29,881	1,504	47,956	2,300	43,338	2,073	22,735	1,270	21,617	1,239

Apparatus and species.	Colleton.				Aiken.				Barnwell.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bream and perch, fresh	2,480	$198	2,600	$208								
Hickory shad, fresh	2,048	98	2,256	113								
Shad, fresh	10,720	992	11,711	1,081								
Striped bass, fresh	2,595	250	2,480	240								
Suckers, fresh	1,375	83	1,260	76								
Other fish, fresh	1,700	100	1,940	110								
Total	20,918	1,721	22,247	1,828								
Gill nets:												
Bream and perch, fresh									3,600	$180	3,440	$172
Hickory shad, fresh	468	20	505	25								
Shad, fresh	8,938	550	12,427	1,022	2,639	$414	2,366	$376	1,040	160	975	150
Sturgeon, fresh	27,300	535	45,500	1,365	9,520	136	8,400	120				
Suckers, fresh									7,330	370	7,226	360
Other fish, fresh	4,800	384	9,800	584	900	60	600	45				
Total	41,506	1,489	68,232	2,996	13,059	610	11,366	541	11,970	710	11,641	682
Miscellaneous nets:												
Catfish, fresh	2,500	50	2,890	60	2,843	162	2,480	140	2,187	130	2,304	144
Shad, fresh	5,525	440	6,500	515					3,523	325	3,029	280
Striped bass, fresh	490	50	400	40								
Other fish, fresh					1,220	75	1,440	90				
Total	8,515	540	9,790	615	4,063	237	3,920	230	5,710	455	5,333	424
Lines:												
Bream and perch, fresh	6,800	424	7,410	454								
Catfish, fresh					10,430	580	11,100	603	7,840	470	6,656	416
Total	6,800	424	7,410	454	10,430	580	11,100	603	7,480	470	6,656	416
Miscellaneous:												
Oysters	7,840	840	8,750	938								
Caviare	2,375	285	1,562	250								
Total	10,215	1,125	10,312	1,188								
Grand total	87,954	5,299	117,991	7,081	27,552	1,427	26,386	1,374	25,520	1,635	23,630	1,522

29.—*Table showing by counties, apparatus, etc., the yield of the shore fisheries of South Carolina*—Continued.

Apparatus and species.	Georgetown and Horry.				Orangeburg.				Berkeley and Charleston.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bream and perch, fresh					500	$40	420	$33				
Channel bass									26,220	$787	30,000	$900
Hick'ry shad, fresh					512	24	568	28	800	38	600	30
Mullet, fresh									96,000	1,600	40,000	1,200
Mullet, salted	240,000	$8,400	329,875	$7,755								
Shad, fresh					2,850	259	2,927	270	4,000	300	3,900	240
Sheepshead, fresh									3,460	105	2,860	85
Spots, fresh									9,010	296	8,950	280
Squeteague, fresh	2,420	145	2,106	120					32,630	979	30,110	900
Striped bass, fresh					700	70	620	60	2,200	220	3,200	320
Sturgeon, fresh									4,860	150	4,500	145
Suckers, fresh					427	25	375	22				
Other fish, fresh	1,870	75	2,040	80	340	30	505	41	13,100	383	13,690	390
Total	244,290	8,620	344,021	7,955	5,369	448	5,415	454	192,280	4,858	137,810	4,490
Gill nets:												
Black bass, fresh	1,995	100	2,100	107								
Bream and perch, fresh	7,247	331	6,320	285	7,200	360	6,880	360				
Channel bass, fresh	8,420	420	6,060	360								
Hick'ry shad, fresh	33,182	995	24,108	720					3,860	193	4,000	200
Mullet, fresh	8,400	210	18,000	450								
Shad, fresh	292,500	21,600	281,836	19,945					109,525	6,885	107,250	6,600
Squeteague, fresh	8,295	495	6,200	360								
Striped bass, fresh									1,800	180	2,060	200
Sturgeon, fresh	198,800	1,420	112,000	1,280								
Suckers, fresh	7,440	310	8,423	340	14,665	735	14,453	722				
Other fish, fresh	15,775	631	14,470	567	975	78	1,200	96	9,800	295	10,000	300
Total	582,054	26,512	479,517	24,414	22,840	1,173	22,533	1,178	124,985	7,553	123,310	7,300
Miscellaneous nets:												
Alewives, fresh	8,000	210	6,460	182								
Catfish, fresh	4,540	136	3,000	90								
Shad, fresh	45,933	3,225	43,983	3,099	7,241	669	6,266	578				
Striped bass, fresh	3,000	240	2,800	224								
Other fish, fresh	1,815	73	1,500	60								
Total	63,288	3,884	57,743	3,655	7,241	669	6,266	578				
Lines:												
Bluefish, fresh									110,060	3,300	100,480	3,060
Bream and perch, fresh	7,490	320	8,290	371	550	44	600	48				
Catfish, fresh	8,530	300	8,700	306					12,850	380	15,064	450
Channel bass, fresh									50,130	1,500	47,540	1,426
Drum, fresh									15,305	450	19,618	590
Sea bass, fresh									350,063	10,500	300,186	9,000
Sheepshead, fresh									30,180	900	32,720	982
Spots and croakers, fresh									29,610	888	25,330	760
Squeteague, fresh									55,048	1,650	50,600	1,518
Whiting, fresh									450,862	18,060	493,750	19,750
Other fish, fresh	4,225	169	4,500	180					391,540	11,730	395,826	11,850
Total	20,245	789	21,490	857	550	44	600	48	1,495,648	49,358	1,481,114	49,386
Miscellaneous:												
Shrimps									360,400	18,020	359,840	17,992
Crabs	1,020	42	1,200	45					83,350	1,250	90,060	1,620
Terrapins	2,250	250	2,700	350					51,075	5,221	51,525	5,725
Oysters	17,500	1,000	18,200	1,300					161,000	13,800	241,500	14,766
Caviare	9,375	1,104	8,750	1,505								
Total	30,145	2,396	30,850	3,200					655,825	38,291	742,925	40,103
Grand total	940,022	42,201	923,621	40,081	36,000	2,334	34,814	2,258	2,468,738	100,060	2,485,159	101,279

29.—Table showing by counties, apparatus, etc., the yield of the shore fisheries of South Carolina—Continued.

Apparatus and species.	Hampton.				Beaufort.				Total.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bream and perch, fresh									2,980	$238	3,020	$241
Catfish, fresh									4,135	124	3,027	91
Channel bass, fresh					4,000	$240	3,000	$187	30,220	1,027	33,000	1,087
Hick'y shad, fresh									5,408	259	5,624	281
Mullet, fresh									96,000	1,600	40,000	1,200
Mullet, salted									240,000	8,400	329,875	7,755
Shad, fresh									25,488	2,340	25,789	2,245
Sheepshead, fresh					3,000	180	2,000	125	6,460	285	4,860	210
Spots, fresh					2,150	130	2,000	125	11,160	426	10,950	405
Squeteague, fresh					4,000	240	3,000	187	39,050	1,364	35,216	1,207
Striped bass, fresh									5,495	540	6,300	620
Sturgeon, fresh									8,060	245	7,262	227
Suckers, fresh									4,783	257	4,775	255
Whiting, fresh					3,000	180	2,000	125	3,000	180	2,000	125
Other fish, fresh					7,850	470	7,200	450	26,237	1,117	26,155	1,101
Total					24,000	1,440	19,200	1,199	508,476	18,402	537,853	17,050
Gill nets:												
Black bass, fresh									1,995	100	2,100	107
Bream and perch, fresh	1,406	$91	2,065	$113					22,503	1,082	22,005	1,060
Channel bass, fresh									8,420	420	6,060	360
Hick'y shad, fresh									37,510	1,208	28,612	945
Mullet, fresh									8,400	210	18,000	450
Shad, fresh	18,187	1,475	16,484	1,646	4,200	240	4,060	232	437,273	31,347	425,658	30,051
Squeteague, fresh									8,295	495	6,200	360
Striped bass, fresh									1,800	180	2,060	200
Sturgeon, fresh	28,300	735	28,000	788			2,800	70	263,920	2,826	196,700	3,623
Suckers, fresh									32,935	1,565	34,047	1,580
Other fish, fresh	760	45	1,330	80					34,960	1,571	40,150	1,758
Total	48,653	2,346	47,879	2,627	4,200	240	6,860	302	858,011	41,004	781,593	40,494
Miscellaneous nets:												
Alewives, fresh									37,160	939	28,600	740
Catfish, fresh	2,600	50	2,730	55					14,970	537	13,804	501
Channel bass, fresh					2,100	130	1,810	113	2,100	130	1,810	113
Shad, fresh									114,696	9,009	111,812	8,891
Spots and croakers, fresh					2,480	152	2,830	177	2,480	152	2,830	177
Squeteague, fresh					3,620	220	3,340	209	3,620	220	3,340	209
Striped bass, fresh									3,490	290	3,200	264
Suckers, fresh									10,875	435	11,050	442
Whiting, fresh					1,100	68	1,020	65	1,100	68	1,020	65
Other fish, fresh					1,370	80	1,000	61	7,010	331	5,650	279
Total	2,600	50	2,730	55	10,670	650	10,000	625	197,501	12,111	183,116	11,681
Lines:												
Bluefish, fresh									110,060	3,300	100,480	3,060
Bream and perch, fresh	4,000	180	4,500	198					77,750	3,819	79,610	3,903
Catfish, fresh	22,950	690	20,000	608					113,058	3,957	112,220	3,931
Channel bass, fresh									50,130	1,500	47,540	1,426
Drum, fresh					155,000	1,645	165,000	1,750	170,305	2,095	184,618	2,340
Sea bass, fresh					7,300	231	6,200	195	357,363	10,731	306,386	9,195
Sheepshead, fresh					2,000	80	1,520	64	32,180	980	34,240	1,046
Spots and croakers, fresh					2,800	130	2,560	108	32,410	1,018	27,890	868
Squeteague, fresh					10,100	400	7,750	310	65,148	2,050	58,350	1,828
Whiting, fresh					36,420	1,460	26,750	990	487,282	19,520	520,500	20,740
Other fish, fresh					4,380	140	2,765	83	434,495	13,411	437,931	13,507
Total	26,950	870	24,500	806	218,000	4,086	212,545	3,500	1,930,181	62,381	1,909,765	61,844
Miscellaneous:												
Shrimps					20,000	1,000	12,000	600	380,400	19,020	371,840	18,592
Crabs					1,860	70	2,000	75	86,230	1,362	93,260	1,740
Terrapins					18,000	1,600	20,723	2,301	71,325	7,071	74,948	8,376
Oysters					119,000	4,250	173,600	6,200	305,340	19,890	442,050	23,204
Caviare	1,000	120	1,200	200			625	25	12,750	1,509	12,137	1,980
Total	1,000	120	1,200	200	158,860	6,920	208,948	9,201	856,045	48,852	994,235	53,892
Grand total	79,203	3,386	76,309	3,688	415,730	13,336	457,553	14,827	4,350,214	182,750	4,406,562	184,961

OYSTER PLANTING AND CANNING.

During the years covered by this report, more attention was given to the question of oyster-culture than ever before in the history of the State, and two large companies were organized with a view to develop the oyster industry. In 1890 about 18,000 bushels of seed oysters were planted, but at the time of the inquiry sufficient time had not elapsed to determine what the results would be. Owing to causes not definitely determined, but probably on account of sand swept in by easterly storms, most of the plants of one company were lost. All the oysters planted in this State are placed in shallow water and are exposed at low tide. The opinion is prevalent that oysters deposited in deep water will not live or thrive because of a luxuriant growth of sea weed which collects sand and mud and ultimately smothers the oysters. Mr. Ravenel believes, however, that oysters will live and improve if they are planted in localities in which sand will not ordinarily accumulate, where the current is swift, and where the nature of the bottom is suitable; he states that experiments in deep-water planting have usually been made at the foot of some bank where mud and sand collect.

Besides the two companies mentioned, about 18 men annually plant from 400 to 2,500 bushels of oysters during the spring and summer months and take them up in the fall and winter for the Charleston market. They are planted in creeks near their homes, at a cost of about 30 cents a bushel, including labor, and bring from 50 cents to $1 per bushel when sold, 75 cents being the average price.

In 1890 two firms, located in Charleston and Berkeley counties, respectively, engaged in canning oysters. The establishment of these works resulted in a large increase in the number of fishermen in these counties, with a corresponding increase in boats and in the quantity of oysters taken, though the low price commanded by the oysters intended for canning prevented any great augmentation in the value of the fishery. One of the factories cans fruits and vegetables as well as oysters, and the other did not begin operations until late in the calendar year 1890, so the results of this branch of the industry, as shown in the following table, were relatively small. Only 20,000 bushels of oysters were utilized and only 106,400 cans were prepared.

30.—Table showing the extent of the oyster-canning industry in South Carolina.

Items.	1890.	Items.	1890.
Number of firms	2	Oysters utilized.....bushels	20,000
Number of persons employed	80	Value paid	$3,000
Value of property	$7,000	Cans prepared.....number	106,400
Cash capital	$4,000	Value	$7,481
Wages paid	$2,800	Enhancement in value	$4,481

IV.—FISHERIES OF GEORGIA.

The coast line of Georgia is shorter than that of any other State in this section, its extreme length following the general trend being only about 100 miles; but it is so broken by numerous sounds, river mouths, and islands that its actual length is probably not less than 500 or 600 miles. The coastal region is physically similar to South Carolina, consisting of a belt of low sandy or marshy islands and peninsulas intervening between the ocean and the mainland. Beginning on the north the principal islands are, in their order, Wassaw, Ossabaw, St. Catherine, Sapelo, St. Simon, Jekyl, and Cumberland; the largest sounds are Wassaw, St. Catherine, Sapelo, Doboy, Altamaha, St. Simon, and Cumberland. The chief rivers are the Savannah, forming the boundary between Georgia and South Carolina, the Ogeechee, Altamaha, Satilla, and St. Marys, the latter intervening between Georgia and Florida.

Savannah, the most important city on the coast of Georgia, is situated on the Savannah River, about 20 miles from the ocean, and is the headquarters of the fisheries and fish trade of the State. Other fishing centers in the coast region are Brunswick, near the head of St. Simon Sound, and Darien.

FISHING-GROUNDS.

The faunal features of the coast and rivers of Georgia are like those of South Carolina. The sounds and river mouths are favorite resorts for numerous salt-water fishes and abound in crabs, shrimps, and terrapin. Sturgeon, striped bass, shad, and alewives periodically ascend the rivers, in which are also found a large variety of catfishes, suckers, sunfishes, and other edible species. The ocean fishing-grounds consist of small isolated coral banks, to which snappers, blackfish, etc., are attracted in large schools by the abundance of food. The principal offshore grounds resorted to by the fishermen of Georgia are as follows: (1) Tybee Ground, described in the chapter on the fisheries of South Carolina; (2) Tybee Deep-water Ground, situated 40 miles southeast from the Tybee light-house, which is about 3 miles long and 2 miles wide, has a depth of 15 to 18 fathoms, has a bottom of corals, "willows," sand, and shells, and is frequented chiefly from January to March for blackfish and snappers; (3) Sapelo Ground, located about 10 miles east of Sapelo Island, is 4 miles long and 1 mile wide, is 9 to 10 fathoms deep, has a bottom consisting of corals and shells, and is visited by Charleston and Savannah fishermen from June to January, blackfish and snappers being caught.

IMPORTANCE AND DEVELOPMENT OF THE FISHERIES.

While the fisheries of Georgia are of less extent than those of any other State in this region, their relatively small importance depends upon the fact that they are undeveloped rather than upon any scarcity of fishery products or upon any difficulties in the way of prosecuting the industry. In the numerous bays and sounds and in the shore waters desirable food-fishes are found in great variety and abundance, but are taken only in small quantities. In the rivers, on the other hand, fishing has been more extensively prosecuted, and it would appear that in the case of the alewives and sturgeon there has been overfishing.

Comparing the extent of the fisheries of Georgia in 1890 with that in 1880, it is to be observed that an advance has occurred in the number of persons employed, the amount of capital invested, and the value of the products of the salt-water fisheries, while in the river fisheries there has been such a serious decline in the value of the sturgeon and alewives that the aggregate output for the State is eleven thousand dollars less than in 1880. The increase in the yield of oysters, shad, terrapin, and squeteague is a noticeable feature of the fisheries in recent years.

The oyster, the most valuable product of the fisheries of Georgia, is the one to which the greatest attention has of late years been directed and on which the State will probably most rely for the improvement of the fisheries in the coastal waters. Up to within a few years, the depletion of the best oyster-grounds in the State had been going on unchecked, and it seemed only a question of time when the beds in the most accessible situations would be almost exhausted. In 1889, however, the legislature enacted an enlightened law, taking effect January 1, 1890, for the regulation and protection of oyster-culture, which placed the industry on a firm footing and is no doubt destined to greatly promote the oyster interests. Under the provisions of the act authorizing the leasing of grounds to private persons for long periods of time and requiring the cultivation of same, the following transactions took place in Chatham, Glynn, and Camden counties in 1890:

Counties.	Area taken for planting purposes.	Oysters planted.	Value.	Shells planted.	Value.
	Acres.	*Bushels.*		*Bushels.*	
Chatham	450	30,000	$3,000	28,000	$1,400
Glynn	5,418	60,000	4,500	10,000	300
Camden	1,378	27,000	2,700	....	....
Total	7,246	117,000	10,200	38,000	1,700

The legislature also authorized the appointment by the governor of an oyster commission, and secured, through the governor, the assistance of the U. S. Coast and Geodetic Survey in making an examination of the waters of the State with reference to their adaptation to oyster-culture. The hydrographic surveys of the littoral waters were conducted by Mr. James C. Drake, ensign U. S. Navy, in the fall and winter of 1889–90, whose investigations had a scope similar to those carried on by the U. S. Fish Commission in South Carolina, of which mention has already been made. The valuable report* of Mr. Drake notes the general depletion of the beds by excessive fishing, the area of the depleted grounds being 1,700 acres. 30,000 acres of bottom, now destitute of oysters, are considered suitable and available for oyster-culture. The report makes the following important reference to oyster-canning and its effects:

> As a means of rapidly depleting the natural beds no more effective method could be instituted than the establishment of factories for the canning of oysters. These in the end will be of great benefit to the State, because the sooner the natural beds are depleted the sooner will the citizens engage in private cultivation, and enact laws that will give inducement to capital.

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*On the sounds and estuaries of Georgia, with reference to oyster-culture. Bulletin No. 19, U. S. Coast and Geodetic Survey, Washington, 1891.

Next to the oyster, the most important product of the fisheries is the shad, the yield of which in point of value is nearly equal to that of all the other fishes of the State. After the shad, the species in the order of their importance are terrapin, squeteague, catfish, and shrimp. In the output of terrapin Georgia is surpassed only by Maryland and Virginia.

CONDENSED STATISTICS OF THE FISHERIES.

From the three tables which follow a general idea may be obtained of the extent and condition of the fisheries in 1889 and 1890.

Table 31 shows that in the latter year 64 persons found employment in the vessel fisheries, 1,357 in the shore or boat fisheries, and 201 in the shore industries, the total number, 1,622, being an increase of 125 over the previous year.

The vessels, boats, apparatus, etc., used in the fisheries and the amount of capital invested are given in Table 32. The 23 vessels employed in 1890 measured 267.74 tons and were valued at $26,800, the apparatus carried on them, consisting of seines and tongs, being worth $1,617 additional. The boats in use numbered 788, and had a value of $9,766. In the shore fisheries the gill net is the most numerous and valuable form of apparatus, after which come the seine, pound net, and cast net, the aggregate value being $12,888. Shore property and working capital constitute the largest investment, amounting to $123,360. The total value of fishing property in 1890 was $174,431, an increase of $53,456 over 1889, the advance being mostly due to additions to the fleet of oyster and fishing vessels and to the working capital.

The quantities and values of the principal products taken in 1889 and 1890 are shown in Table 33. In the former year, 2,643,533 pounds of fish, oysters, shrimp, etc., were landed, valued at $105,727; in 1890 the catch was 2,994,117 pounds, worth $123,563. The value of oysters is greater than any other species, amounting to $40,520 in 1890, after which are shad worth $30,918, terrapin worth $9,107, squeteague worth $7,911, catfish worth $8,175, and shrimp worth $6,081. The increase in the value of the yield in 1890 as compared with the previous years depended largely on an important augmentation of the oyster output.

31.—Table of persons employed.

How engaged.	Number.	
	1889.	1890.
In vessel fisheries	29	50
On transporting vessels	3	14
In shore fisheries	1,294	1,357
On shore, in fish-houses, etc	171	201
Total	1,497	1,622

32.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels fishing	13	$6,675	20	$10,025
Tonnage	118.50		212.33	
Outfit		3,960		3,375
Vessels transporting	2	4,000	3	11,000
Tonnage	27.37		55.41	
Outfit		850		2,400
Boats	725	7,384	788	9,766
Apparatus of capture—vessel fisheries:				
Seines	9	423	28	1,305
Tongs	13	104	40	312
Apparatus of capture—shore fisheries:				
Seines	18	587	23	747
Gill nets	373	7,458	398	7,957
Cast nets	152	760	148	740
Fyke nets	9	240	11	285
Pound nets	5	1,250	5	1,250
Skim nets	297	867	307	893
Small traps	76	123	76	124
Lines		294		306
Tongs	112	560	117	586
Shore property		49,240		51,560
Cash capital		36,200		71,800
Total		120,975		174,431

33.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Alewives	36,000	$720	24,000	$580
Bream and perch	20,385	974	18,400	888
Catfish	192,251	8,122	192,232	8,175
Channel bass	32,095	1,762	38,870	2,215
Drum	16,580	331	15,000	300
Hickory shad	18,400	921	23,100	1,150
Mullet	57,425	2,589	52,740	2,381
Sea bass	8,200	492	10,000	600
Shad	356,352	27,000	399,660	30,918
Sheepshead	5,165	310	5,000	300
Spots and croakers	14,185	807	13,800	790
Squeteague	130,337	7,183	144,000	7,911
Striped bass	13,260	1,100	9,000	720
Sturgeon	206,360	3,838	80,560	1,497
Suckers	5,692	299	5,923	311
Whiting	11,790	660	18,374	1,060
Miscellaneous	136,274	7,640	112,897	6,259
Oysters	*1,142,400	26,684	‡1,570,485	40,520
Quahogs	†3,200	250	§4,000	300
Shrimps	150,000	5,975	162,160	6,081
Crabs	43,267	935	47,866	1,060
Terrapins	38,040	6,270	43,050	9,107
Caviare	5,875	865	3,000	440
Total	2,643,533	105,727	2,994,117	123,563

* 163,200 bushels. † 224,357 bushels. ‡ 400 bushels. § 500 bushels.

THE FISHERIES CONSIDERED BY COUNTIES.

Of the twenty counties the fisheries of which are covered by this report, only six are directly on the seaboard, the remainder being on the Savannah, Altamaha, and other rivers. The coastal counties are Chatham, Bryan, Liberty, McIntosh, Glynn, and Camden.

The fisheries of Chatham County are much more important than those of all the other counties combined It has the most numerous fishing population, the greatest amount of invested capital, and the largest and most valuable yield. The only vessel fishing in the State is carried on from this county, and in the catch of nearly all of the principal products—shad, oysters, shrimp, terrapin, etc.—it takes the lead. Glynn County ranks next to Chatham in the general importance of the industry, surpassing the latter in the extent of the mullet and squeteague fisheries. The other coast counties in the order of their rank are Bryan, Camden, McIntosh, and Liberty.

The three tables which follow give a detailed view of the fisheries by counties. The minor (mostly semi-professional) fishing on the rivers does not seem to require separation into counties.

34.—Table showing by counties the number of persons employed in the fisheries of Georgia in 1889 and 1890.

Counties.	On vessels fishing.		On vessels transporting.		In shore fisheries.		On shore, in fish-houses, etc.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Richmond, Burke, and Screven					72	67			72	67
Chatham	29	50	3	14	314	302	96	114	442	480
Bryan					70	71			70	71
McIntosh					45	43			45	43
Laurens, Montgomery, Tattnall, Liberty, Pulaski, Dodge, Wilcox, Telfair, Coffee, Appling, and Wayne					650	677			650	677
Glynn					120	156	75	87	195	243
Camden					23	41			23	41
Total	29	50	3	14	1,294	1,357	171	201	1,497	1,622

35.—Table showing by counties the apparatus and capital employed in the fisheries of Georgia in 1889 and 1890.

Designation.	Richmond, Burke, and Screven.				Chatham.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					13	$6,675	20	$10,025
Tonnage					118.50		212.33	
Outfit						3,960		3,375
Vessels transporting					1	1,000	1	3,500
Tonnage					15.69		14.37	
Outfit						100		800
Boats	35	$218	32	$202	200	3,348	197	3,318
Apparatus of capture—vessel fisheries:								
Seines					9	423	28	1,305
Tongs					13	104	40	312
Apparatus of capture—shore fisheries:								
Seines					10	360	14	520
Gill nets	39	310	38	308	75	3,629	84	3,870
Cast nets	10	50	8	40	105	525	100	500
Fyke nets					7	230	8	270
Skim nets	6	18	5	15				
Small traps	26	39	27	41				
Lines		91		93		105		111
Tongs					96	480	100	500
Shore property		50		50		39,400		40,620
Cash capital						33,200		41,700
Total		776		749		93,539		110,726

35.—*Table showing by counties the apparatus and capital employed in the fisheries of Georgia*—Continued.

Designation.	Bryan.				McIntosh.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	42	$642	41	$562	30	$435	27	$287
Apparatus of capture:								
Seines	1	12	1	12	3	75	3	75
Gill nets	42	1,479	45	1.665	14	430	14	300
Cast nets					8	40	8	40
Fyke nets	2	10	3	15				
Pound nets	5	1.250	5	1.250				
Lines		8		5		3		2
Tongs					6	30	3	15
Shore property		2,100		2,280		250		250
Total		5,501		5.789		1.263		969

Designation.	Laurens, Montgomery, Tattnall, Liberty, Pulaski, Dodge, Wilcox, Telfair, Coffee, Appling, and Wayne.				Glynn.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting					1	$3,000	2	$7,500
Tonnage					11.68		41.04	
Outfit						750		1,600
Boats	337	$1,023	352	$1,057	67	1,387	107	3,684
Apparatus of capture:								
Seines					4	140	5	140
Gill nets	160	320	164	339	36	1,095	45	1,240
Cast nets					22	110	26	128
Skim nets	291	849	302	878				
Small traps	50	84	49	83				
Lines		77		85		8		8
Tongs					8	40	11	56
Shore property						7,200		8,110
Cash capital						3,000		23,000
Total		2,353		2,442		16,730		45,466

Designation.	Camden.				Total.			
	1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels fishing					13	$6,675	20	$10,025
Tonnage					118.50		212.33	
Outfit						3,960		3,375
Vessels transporting					2	4,000	3	11,000
Tonnage					27.37		55.41	
Outfit						850		2,400
Boats	14	$331	32	$656	725	7,384	788	9,766
Apparatus of capture—vessel fisheries:								
Seines					9	423	28	1,305
Tongs					13	104	40	312
Apparatus of capture—shore fisheries:								
Seines					18	587	23	747
Gill nets	7	195	8	235	373	7,458	398	7,957
Cast nets	7	35	6	32	152	760	148	740
Fyke nets					9	240	11	285
Pound nets					5	1,250	5	1,250
Skim nets					297	867	307	893
Small traps					76	123	76	124
Lines		2		2		294		306
Tongs	2	10	3	15	112	560	117	586
Shore property		240		250		49,240		51,560
Cash capital				7,100		36,200		71,800
Total		813		8,290		120,975		174,431

36.—Table showing by counties and species the yield of the fisheries of Georgia in 1889 and 1890.

Species.	Richmond, Burke, and Screven.				Chatham.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives					8,000	$300	8,000	$340
Bream and perch	2,480	$124	2,120	$120	4,344	198	3,336	148
Catfish	46,665	2,832	45,751	2,776	72,624	2,180	72,052	2,177
Channel bass					13,675	784	20,850	1,250
Drum					12,000	240	10,000	200
Hickory shad					12,000	600	13,060	648
Mullet					19,225	961	15,360	768
Sea bass					8,200	492	10,000	600
Shad	6,500	971	6,022	902	123,470	9,590	138,775	11,650
Sheepshead					5,165	310	5,000	300
Spots and croakers					9,835	590	10,000	600
Squeteague					51,917	3,115	51,000	3,060
Striped bass					8,200	700	5,000	400
Sturgeon	16,800	240	25,200	360	119,000	2,200	34,580	704
Suckers	1,675	100	1,430	86				
Whiting					7,800	460	14,184	850
Miscellaneous	6,247	382	5,920	368	90,123	5,267	61,041	3,591
Oysters					674,800	18,620	863,100	29,045
Quahogs					3,200	250	4,000	300
Shrimps					120,000	4,500	136,160	5,106
Crabs					41,667	855	46,666	1,000
Terrapins					31,140	5,190	34,020	7,690
Caviare					4,625	700	2,750	400
Total	80,367	4,649	86,443	4,612	1,441,010	58,102	1,558,934	70,817

Species.	Bryan.				McIntosh.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	28,000	$420	16,000	$240				
Bream and perch	6,516	300	5,004	222				
Catfish	25,554	730	25,663	784				
Channel bass					3,460	$230	3,000	$215
Hickory shad	4,800	240	8,040	402	850	43	1,100	55
Mullet					4,000	260	4,180	285
Shad	97,305	7,485	114,725	8,825	15,080	696	20,475	945
Squeteague					9,920	640	10,500	726
Striped bass	5,060	400	4,000	320				
Sturgeon	33,600	600	15,120	270	25,200	540	2,860	143
Miscellaneous	5,034	210	5,563	219	3,870	232	4,113	267
Oysters					14,000	400	8,400	240
Terrapins					4,500	750	1,980	385
Caviare	375	60	250	40				
Total	206,244	10,445	194,365	11,322	80,880	3,791	56,608	3,261

Species.	Laurens, Montgomery, Tattnall, Liberty, Pulaski, Dodge, Wilcox, Telfair, Coffee, Appling, and Wayne.				Glynn.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Bream and perch	7,045	$352	7,940	$398				
Catfish	47,408	2,380	48,766	2,438				
Channel bass					12,000	$600	11,920	$595
Drum					3,664	73	4,000	80
Hickory shad					750	38	900	45
Mullet					26,900	1,076	25,980	1,039
Shad	99,177	7,574	99,863	7,681	14,820	684	19,800	915
Spots and croakers					3,480	174	3,000	150
Squeteague					54,840	2,742	65,700	3,285
Sturgeon	3,640	26	2,800	20	8,120	232		
Suckers	4,017	199	4,493	225				
Whiting					3,040	152	3,180	159
Miscellaneous	940	46	1,360	69	24,170	1,209	27,920	1,396
Oysters					362,880	6,132	559,188	8,996
Shrimps					25,000	1,195	21,200	795
Crabs					1,280	64	960	48
Terrapins					1,920	265	5,640	826
Caviare					875	105		
Total	162,227	10,577	165,222	10,831	543,739	14,741	749,388	18,329

36.—Table showing by counties and species the yield of the fisheries of Georgia in 1889 and 1890—Continued.

Species.	Camden.				Total for the State.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	....	....	....	....	36,000	$720	24,000	$580
Bream and perch	....	....	....	....	20,385	974	18,400	888
Catfish	....	....	....	....	192,251	8,122	192,232	8,175
Channel bass	2,960	$148	3,100	$155	32,095	1,762	38,870	2,215
Drum	916	18	1,000	20	16,580	331	15,000	300
Hickory shad	....	....	....	....	18,400	921	23,100	1,150
Mullet	7,300	292	7,220	289	57,425	2,589	52,740	2,381
Sea bass	....	....	....	....	8,200	492	10,000	600
Shad	....	....	....	....	356,352	27,000	399,660	30,918
Sheepshead	....	....	....	....	5,165	310	5,000	300
Spots and croakers	870	43	800	40	14,185	807	13,800	790
Squeteague	13,660	686	16,800	840	130,337	7,183	144,000	7,911
Striped bass	....	....	....	....	13,260	1,100	9,000	720
Sturgeon	....	....	....	....	206,360	3,838	80,560	1,497
Suckers	....	....	....	....	5,692	299	5,923	311
Whiting	950	48	1,010	51	11,790	660	18,374	1,060
Miscellaneous	5,890	294	6,980	349	136,274	7,640	112,897	6,259
Oysters	90,720	1,532	139,797	2,249	1,142,400	26,684	1,570,485	40,520
Quahogs	....	....	....	....	3,200	250	4,000	300
Shrimps	5,000	280	4,800	180	150,000	5,975	162,160	6,081
Crabs	320	16	240	12	43,267	935	47,866	1,060
Terrapins	480	65	1,410	206	38,040	6,270	43,050	9,107
Caviare	....	....	....	....	5,875	865	3,000	440
Total	129,066	3,422	183,157	4,391	2,643,533	105,727	2,994,117	123,563

PRODUCTS WITH REFERENCE TO APPARATUS USED.

In the limited vessel fishing now carried on in Georgia, seines and tongs are the only forms of apparatus used, and terrapin and oysters are the only products taken. The results of this fishery in the two years covered by this report are shown in the following table, which relates to Chatham County, to which the use of vessels is confined:

37.—Table showing by apparatus the yield of the vessel fisheries of Georgia in 1889 and 1890.

Apparatus and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Tongs:				
Oysters	*205,800	$5,220	†250,600	$7,160
Seines:				
Terrapin	‡22,140	3,690	§28,152	6,316
Total	227,940	8,910	278,752	13,476

*29,400 bushels. †35,800 bushels. ‡7,380 in number. §9,384 in number.

The kinds of apparatus employed in the shore fisheries are much more numerous, and the following table, giving the quantities and value of products taken in each form, presents some interesting facts for the different counties. The most important means of capture are gill nets. In 1890 these took 608,662 pounds of fish, valued at $37,063. The next prominent apparatus are lines, which yielded 353,272 pounds of fish, worth $17,887. The other forms of apparatus used in the capture of fish proper—seines, pound nets, cast nets, fyke nets, etc.—are relatively unimportant.

38.—Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia in 1889 and 1890.

Apparatus and species.	Richmond, Burke, and Screven.				Chatham.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Channel bass					3, 675	$184	5, 850	$350
Mullet					3, 225	161	5, 360	268
Whiting					2, 000	120	4, 184	250
Miscellaneous fish					3, 600	160	4, 066	203
Total					12, 500	625	19, 460	1, 071
Gill nets:								
Hickory shad					12, 000	600	13, 060	648
Mullet					16, 000	800	10, 000	500
Shad	4, 680	$747	4, 397	$702	123, 470	9, 590	138, 775	11, 650
Squeteague					11, 917	715	16, 000	960
Sturgeon	16, 800	240	25, 200	360	119, 000	2, 200	34, 580	704
Miscellaneous fish	4, 220	262	4, 000	250	6, 500	325	4, 363	240
Total	25, 700	1, 249	33, 597	1, 312	288, 887	14, 230	216, 778	14, 702
Cast nets:								
Bream and perch	2, 480	124	2, 120	120				
Catfish	1, 325	90	1, 290	87				
Suckers	1, 675	100	1, 430	86				
Miscellaneous fish	857	50	920	55				
Total	6, 337	364	5, 760	348				
Fyke nets:								
Alewives					8, 000	300	8, 000	340
Catfish					7, 000	210	5, 000	163
Striped bass					6, 000	480	3, 000	240
Total					21, 000	990	16, 000	743
Skim nets:								
Shad	1, 820	224	1, 625	200				
Miscellaneous fish	280	15	200	13				
Total	2, 100	239	1, 825	213				
Small traps:								
Catfish	6, 770	407	6, 818	404				
Lines:								
Bream and perch					4, 344	198	3, 336	148
Catfish	38, 570	2, 335	37, 643	2. 285	65, 624	1, 970	67, 052	2, 014
Channel bass					10, 000	600	15, 000	900
Drum					12, 000	240	10, 000	200
Sea bass					8, 200	492	10, 000	600
Sheepshead					5, 165	310	5, 000	300
Spots and croakers					9, 835	590	10, 000	600
Squeteague					40, 000	2, 400	35, 000	2, 100
Striped bass					2, 200	220	2, 000	160
Whiting					5, 800	340	10, 000	600
Miscellaneous fish	890	55	800	50	80, 023	4, 782	52, 612	3, 148
Total	39, 460	2, 390	38, 443	2, 335	243. 191	12, 142	220, 000	10, 770
Miscellaneous:								
Oysters					469, 000	13, 400	612, 500	21, 875
Quahogs					3, 200	250	4, 000	300
Shrimps					120, 000	4, 500	136, 160	5, 106
Crabs					41, 667	855	46, 666	1, 000
Terrapins					9, 000	1, 500	5, 868	1, 374
Caviare					4, 625	700	2, 750	400
Total					647, 492	21, 205	807, 944	30, 055
Grand total	80, 367	4. 649	86, 443	4, 612	1, 213, 070	49, 192	1, 280, 182	57, 341

38.—Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia in 1889 and 1890—Continued.

Apparatus and species.	Bryan.				McIntosh.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Miscellaneous fish	2,500	$100	2,970	$110	....	....	....	....
Gill nets:								
Hickory shad	4,800	240	8,040	402	850	$43	1,100	$55
Shad	97,305	7,485	113,100	8,700	15,080	696	20,475	945
Sturgeon	33,600	600	15,120	270	25,200	540	2,860	143
Total	135,705	8,325	136,260	9,372	41,130	1,279	24,435	1,143
Cast nets:								
Mullet	....	....	....	....	4,000	260	4,180	285
Squeteague	....	....	....	....	1,120	68	1,230	81
Miscellaneous fish	....	....	....	....	1,870	112	1,960	127
Total	....	....	....	....	6,990	440	7,370	493
Fyke nets:								
Catfish	1,715	60	2,515	88	....	....	....	....
Miscellaneous fish	1,000	40	1,675	67	....	....	....	....
Total	2,715	100	4,190	155	....	....	....	....
Pound nets:								
Alewives	28,000	420	16,000	240	....	....	....	....
Catfish	19,890	560	20,070	600	....	....	....	....
Shad	....	....	1,625	125	....	....	....	....
Striped bass	5,060	400	4,000	320	....	....	....	....
Total	52,950	1,380	41,695	1,285	....	....	....	....
Lines:								
Bream and perch	6,516	300	5,004	222	....	....	....	....
Catfish	3,949	110	3,078	96	....	....	....	....
Channel bass	....	....	....	....	3,460	230	3,000	215
Squeteague	....	....	....	....	8,800	572	9,270	645
Miscellaneous fish	1,534	70	918	42	2,000	120	2,153	140
Total	11,999	480	9,000	360	14,260	922	14,423	1,000
Miscellaneous:								
Oysters	....	....	....	....	14,000	400	8,400	240
Terrapins	....	....	....	....	4,500	750	1,980	385
Caviare	375	60	250	40	....	....	....	....
Total	375	60	250	40	18,500	1,150	10,380	625
Grand total	206,244	10,445	194,365	11,322	80,880	3,791	56,608	3,261

38.—*Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia in 1889 and 1890*—Continued.

Apparatus and species.	Laurens, Montgomery, Tattnall, Liberty, Pulaski, Dodge, Wilcox, Telfair, Coffee, Appling, and Wayne.				Glynn.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:								
Bream and perch	4,205	$210	4,840	$243				
Channel bass					8,160	$408	7,920	$395
Hickory shad					750	38	900	45
Mullet					19,700	788	21,500	860
Shad	42,055	3,180	41,779	3,213	14,820	684	19,800	915
Squeteague					42,000	2,100	50,500	2,525
Sturgeon	3,640	26	2,800	20	8,120	232		
Suckers	4,017	199	4,493	225				
Miscellaneous fish	940	46	1,360	69	14,370	719	16,400	820
Total	54,857	3,661	55,272	3,770	107,920	4,969	117,020	5,560
Cast nets:								
Mullet					7,200	288	4,480	179
Squeteague					8,640	432	11,200	560
Miscellaneous fish					3,520	176	4,000	200
Total					19,360	896	19,080	939
Skim nets:								
Shad	57,122	4,394	58,084	4,468				
Small traps:								
Catfish	13,943	707	12,850	641				
Lines:								
Bream and perch	2,840	142	3,100	155				
Catfish	33,465	1,673	35,916	1,797				
Channel bass					3,840	192	4,000	200
Drum					3,664	73	4,000	80
Spots and croakers					3,480	174	3,000	150
Squeteague					4,200	210	4,000	200
Whiting					3,040	152	3,180	159
Miscellaneous fish					6,280	314	7,520	376
Total	36,305	1,815	39,016	1,952	24,504	1,115	25,700	1,165
Miscellaneous:								
Oysters					362,880	6,132	559,188	8,996
Shrimps					25,000	1,195	21,200	795
Crabs					1,280	64	960	48
Terrapins					1,920	265	5,640	826
Caviare					875	105		
Total					391,955	7,761	586,988	10,665
Grand total	162,227	10,577	165,222	10,831	543,739	14,741	749,388	18,329

38.—Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia—Continued.

Apparatus and species.	Camden.				Total for the State.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Channel bass					3,675	$184	5,850	$350
Mullet					3,225	161	5,360	268
Whiting					2,000	120	4,184	250
Miscellaneous fish					6,100	260	7,036	313
Total					15,000	725	22,430	1,181
Gill nets:								
Bream and perch					4,205	210	4,840	243
Channel bass	2,000	$100	2,100	$105	10,160	508	10,020	500
Hickory shad					18,400	921	23,100	1,150
Mullet	5,500	220	6,100	244	41,200	1,808	37,600	1,604
Shad					297,410	22,382	338,326	26,125
Squeteague	10,500	525	13,000	650	64,417	3,340	79,500	4,135
Sturgeon					206,360	3,838	80,560	1,497
Suckers					4,017	199	4,493	225
Miscellaneous fish	3,560	178	4,100	205	29,590	1,530	30,223	1,584
Total	21,560	1,023	25,300	1,204	675,759	34,736	608,662	37,063
Cast nets:								
Bream and perch					2,480	124	2,120	120
Catfish					1,325	90	1,290	87
Mullet	1,800	72	1,120	45	13,000	620	9,780	509
Squeteague	2,100	108	2,800	140	11,860	608	15,230	781
Suckers					1,675	100	1,430	86
Miscellaneous fish	880	44	1,000	50	7,127	382	7,880	432
Total	4,780	224	4,920	235	37,467	1,924	37,730	2,015
Fyke nets:								
Alewives					8,000	300	8,000	340
Catfish					8,715	270	7,515	251
Striped bass					6,000	480	3,000	240
Miscellaneous fish					1,000	40	1,675	67
Total					23,715	1,090	20,190	898
Pound nets:								
Alewives					28,000	420	16,000	240
Catfish					19,890	560	20,070	600
Shad							1,625	125
Striped bass					5,060	400	4,000	320
Total					52,950	1,380	41,695	1,285
Skim nets:								
Shad					58,942	4,618	59,709	4,668
Miscellaneous fish					280	15	200	13
Total					59,222	4,633	59,909	4,681
Small traps:								
Catfish					20,713	1,114	19,668	1,045
Lines:								
Bream and perch					13,700	640	11,440	525
Catfish					141,608	6,088	143,689	6,192
Channel bass	960	48	1,000	50	18,260	1,070	23,000	1,365
Drum	916	18	1,000	20	16,580	331	15,000	300
Sea bass					8,206	492	10,000	600
Sheepshead					5,165	310	5,000	300
Spots and croakers	870	43	800	40	14,185	807	13,800	790
Squeteague	1,060	53	1,000	50	54,060	3,235	49,270	2,995
Striped bass					2,200	220	2,000	160
Whiting	950	48	1,010	51	9,790	540	14,190	810
Miscellaneous fish	1,450	72	1,880	94	92,177	5,413	65,883	3,850
Total	6,206	282	6,690	305	375,925	19,146	353,272	17,887
Miscellaneous:								
Oysters	90,720	1,532	139,797	2,249	936,600	21,464	1,319,885	33,360
Quahogs					3,200	250	4,000	300
Shrimps	5,000	280	4,800	180	150,000	5,975	162,160	6,081
Crabs	320	16	240	12	43,267	935	47,866	1,060
Terrapins	480	65	1,410	206	15,900	2,580	14,898	2,791
Caviare					5,875	865	3,000	440
Total	96,520	1,893	146,247	2,647	1,154,842	32,069	1,551,809	44,032
Grand total	129,066	3,422	183,157	4,391	2,415,593	96,817	2,715,365	110,087

SHORE INDUSTRIES.

The most important of the shore fishing-industries of this State is the wholesale trade in fresh fish, turtles, terrapins, oysters, shrimps, crabs, etc., which is centered at Savannah and Thunderbolt. Six firms, employing 114 persons in various capacities and having over $70,000 invested, are engaged in buying products from the fishermen of this and other States and in shipping them to southern, western, and northern markets. 2,400 tons of ice, valued at $12,000, were consumed in 1890 in the preservation of the products during and prior to transportation. This business is very extensive; in 1890 the quantity of fish, etc., purchased and sold was 9,465,501 pounds, for which the dealers paid $392,719, while the gross sales were probably not less than $1,000,000. The principal details of this trade are brought out in the following table. The mullet, sheepshead, squeteague, channel bass, miscellaneous fish, green turtle, and 290,595 of the shad came from Florida. The snappers were caught by New England smacks fishing off the Florida coast and landing their fares in Savannah. The oysters, crabs, shrimps, terrapins, and 32,000 of the shad were taken by local fishermen. Oysters are shipped in the shell and also shucked, most of the employés recorded being engaged in opening oysters in Savannah and Thunderbolt.

39.—Table showing the extent of the wholesale fish trade of Chatham County, Georgia, in 1890.

Items.	Number.	Value.
Number of firms	6	
Persons employed:		
White	13	
Colored	101	
Value of property		$39,100
Cash capital		34,200
Tons of ice used	2,400	12,000
Products handled:		
Channel bass ... pounds	209,000	$11,495
Mullet ... do	4,183,400	104,585
Shad ... do	*1,048,434	80,649
Sheepshead ... do	390,000	20,450
Snappers ... do	1,500,000	45,000
Squeteague ... do	445,000	24,475
Miscellaneous fish ... do	315,000	17,325
Green turtle ... do	80,000	8,000
Terrapins ... do	†138,160	10,360
Shrimps ... do	‡148,000	6,475
Crabs ... do	§31,900	798
Oysters ... do	‖1,076,607	63,107
Total number of pounds and value paid	9,465,501	392,719

* 322.595 in number. † 12.720 in number. ‡ 3,700 bushels. § 95.700 in number.
‖ 153.801 bushels; most of the oysters were sold in an opened condition.

The retail fish trade is an important part of the industrial life of Savannah. There are eleven regular fish-stalls in the city market, which are the property of the city and are annually rented for $202 to $305 each. Nine of the stalls are kept open throughout the year, but two are not used regularly except on Saturday night, when the sale of catfish forms the bulk of the business. In 1890 22 men were engaged in this trade, $3,225 was paid for rent, the capital invested was about $12,000, and the cash required to properly run the industry was $10,000.

The following estimate of the extent of the retail fish trade was obtained by the agent of the office. The source of the retail fish supply is the same as that of the wholesale trade.

40.—Table showing the extent of the retail fish trade of Savannah, Ga., in 1890.

Species.	Pounds.	Cost price.	Selling price.
Catfish	70,000	$2,100	$4,550
Channel bass	100,000	5,000	8,000
Mullet	362,000	9,995	28,960
Sea bass	70,000	4,200	5,600
Shad	150,000	12,000	18,750
Sheepshead	60,000	3,000	4,800
Snapper	150,000	9,000	15,000
Squeteague	150,000	6,000	12,000
Whiting	30,000	1,500	2,400
Miscellaneous salt-water fish	100,000	6,000	8,000
Miscellaneous fresh-water fish	80,000	4,800	6,400
Oysters	*20,000	1,200	1,600
Clams	†1,600	120	200
Total	1,343,600	64,875	116,200

* 2,000 gallons. † 200 bushels.

The canning of oysters is a branch of the fishing industry that is carried on in one county of this State. In 1889, 268,000 cans were prepared, the market value of which was $18,750, and in 1890, 479,720 cans were put up, which sold for $37,561. The quantity of oysters handled was 50,000 bushels the first year and 89,500 bushels the next season; the price paid was 10 cents a bushel.

41.—Table showing the extent of the oyster-canning industry of Georgia in 1889 and 1890.

Items.	1889.	1890.
Number of canneries	1	1
Number of persons employed	70	87
Value of property	$6,000	$7,000
Cash capital	$3,000	$3,000
Oysters utilized ... bushels	50,000	89,500
Value paid	$5,000	$8,950
Cans prepared ... number	268,000	479,720
Value	$18,750	$37,561

V.—FISHERIES OF EASTERN FLORIDA.

DESCRIPTION OF THE COAST AND RIVERS.

The coast of eastern Florida, following the general trend, is about 450 miles in length, but the numerous rivers, bays, and lagoons give to the State a much more extensive shore line. At the extreme northern part of the State the St. Marys River forms the boundary between Georgia and Florida, and empties into Cumberland Sound. Below this is Nassau Sound, into the head of which the Nassau River flows. The next important interruption in the shore line is the St. Johns River, from which to the southern extremity of the coast there is an almost continuous line of long, narrow lagoons or rivers which communicate with the ocean at irregular intervals; these are the North River, Matanzas River or Lagoon, Halifax River, Mosquito Lagoon or Hillsboro River, Indian River, Lake Worth, and Biscayne Bay.

The principal fishing centers are Fernandina, the largest coast town of eastern Florida, situated on Amelia Island and separated from the mainland by the river of the same name; Mayport, Fulton, New Berlin, Arlington, Jacksonville, and Palatka, on the St. John River; Enterprise, Sanford, and Monroe, on Lake Monroe; St. Augustine, on Matanzas Lagoon; Ormond, Daytona, and New Smyrna, on Mosquito Lagoon and Halifax River; and Titusville, on the Indian River.

The following description has been given of the physical condition and natural fishery resources of eastern Florida:

> The eastern portion of the State is a remarkably level section, rising but a few feet above the sea. The land is composed wholly of sand and broken shells, covered here and there by a thin layer of vegetable mold. The higher ridges of the region are covered with a scattered growth of pine, while the intervening depressions, which are submerged to a depth of from a few inches to several feet, support a rank growth of various swamp grasses, or are covered with dense thickets of cypress, palmetto, magnolia, and ash. Even in the higher pine lands one finds a great number of land-locked ponds and lakes varying from a few rods to several miles in extent. Along the ocean shore the current has thrown up low sandy bars for nearly the entire length of the State; and behind these are shallow lagoons or arms of the sea, with here and there an opening to the ocean. These lagoons, called by the inhabitants rivers, are often broad sheets of salt or brackish water, extending continuously for many miles along the coast, and with but few interruptions along the entire eastern shore of the State. They usually connect with the ocean by means of shallow inlets separated from each other by a considerable distance; and, although very shallow, are often navigable by boats and shoal-draft vessels for their entire length. In the still water of these lagoons many of the salt-water species find an agreeable change from the rougher water outside, some come in to spawn, while others are led to enter inlets in pursuit of food. During the winter months immense quantities of fish may be found in these places, but in summer the water becomes so warm that most of them are driven out into the sea. The saltness of the water varies greatly, being wholly dependent upon the amount of rainfall in the locality. During seasons of continued drought the lagoons are fed from the ocean, when they become very salt. During rainy seasons, however, they are often quite fresh, except at and near the inlets. The freshening of the water has a decided influence on its fauna. The oysters of an entire bay are at times wholly destroyed, while the fish are driven to the inlets, where the water is always more or less salt. An excellent opportunity is thus given for extensive fisheries, as immense quantities of fish can readily be taken with suitable apparatus.
>
> Just beyond these salt or brackish lagoons of the shore, at a distance varying from 10 to 30 miles, lies the St. Johns River. It is fed by thousands of square miles of shoal grassy swamps, in which the river takes its rise. It is a sluggish stream, extending through nearly three degrees of latitude, and by means of its numerous and intricate windings the water is carried about 400 miles before it reaches the sea. It is navigable by small inland steamers for fully 350 miles. In its central portion the river often expands into small lakes several miles in extent, and as suddenly contracts into a mere creek only a few rods wide. In its lower third it is merely a succession of shallow lakes from 2 to 15 miles in breadth. It is said that the river has but 4 feet of fall during its entire course. For this reason

> the current is usually quite sluggish, and the ocean tide extends to Lake George, situated 158 miles from the sea, while the water is usually brackish for a considerable distance beyond Jacksonville. Lake George is the prettiest and clearest sheet of water on the entire river. It is 12 miles wide by 16 to 20 long, and abounds in fish of various species, being seemingly the summer home of large numbers of mullet. There are several salt springs in various parts of the lake, and the fishermen claim that many of the mullet spawn there instead of taking the long trip to the sea. Probably no point on the St. Johns River affords better facilities for an extensive mullet fishery than Lake George. Fish of large size are reported to be remarkably abundant during the entire year, and it is said that they can be taken in any quantity desired. The distance from a suitable market might interfere with any extensive shipping of fresh mullet, but it seems probable that any party familiar with the proper methods of salting and curing fish could establish a very profitable business in the salting and shipping of mullet to other States, especially North and South Carolina. Lake Monroe, a sheet of water 5 miles wide by 10 long, is another expansion of the St. Johns River 240 miles above its mouth. Lake Harney, about 265 miles above the mouth of the St. Johns, is the highest point on the river where the fisheries have been prosecuted. The lake, which is only 5 or 6 miles in diameter, is so shoal that a common seine will scrape the bottom in almost every part.[*]

Mosquito Lagoon and Indian River are the principal bodies of water on the coast having connection with the fisheries. Mosquito Lagoon is, next to Indian River, the largest of the shallow waters on the east coast. It is 60 miles long and about its middle is connected with the ocean by means of a narrow opening known as Mosquito Inlet. The northern extension of the lagoon is called Halifax River. This area contains fish in large variety and great abundance, the supply of mullet being noticeably plentiful. The green turtle is also common. Indian River lies immediately south of Mosquito Lagoon and extends parallel with the coast for more than 150 miles. The region is rich in aquatic life, turtles, mullet, sheepshead, and squeteague being especially numerous.

IMPORTANCE AND NATURE OF THE FISHERIES.

The fisheries of eastern Florida rank next to those of North Carolina in importance. The special branches in which the State takes precedence over others in this section are unimportant, the rank of the State depending on a generally flourishing condition of the river and coast fisheries. The most prominent fisheries of eastern Florida are the shad and mullet; the value of these is considerably more than that of all other products combined, and the shad alone represents nearly half the total output of the fisheries.

The principal means of capture employed are gill nets and seines, with which the largest quantities of the most valuable products are obtained. Cast nets, lines, and minor forms are also in use, and recently pound nets have been introduced in limited numbers. The absence of vessels employed in the capture of fishery products is a unique feature of this coast.

Since 1880 there has been a steady increase in the fisheries of eastern Florida, until, at the present time, the value of the product is nearly three times greater than ten years ago. The advance has been marked in both the salt-water and the fresh-water fisheries, but is especially noticeable in the shad, mullet, oyster, and squeteague fisheries; the value of the shad catch is five times greater than in 1880; the yield of mullet is more than twice as large, although the value is relatively less; the quantity and value of oysters taken is about three times as great, and the value of the squeteague over three times as much. The advance is due to an increase in the number of fishermen and to an increased interest in the industry.

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[*] Eastern Florida and its Fisheries, by R. Edward Earll. <The Fisheries and Fishery Industries of the United States, section II. Geographical Review of the Fisheries.

GENERAL STATISTICS OF EASTERN FLORIDA.

In the three following tables the extent of the fishery interests of the eastern part of Florida are shown in condensed form. The figures include the fisheries of the coastal waters, lagoons, and rivers as far south as Lake Worth, and the basin of the St. Johns River to Lake Monroe. The inquiry was not addressed to the alligator industry, as the time available would not permit a canvass of the interior waters where most of the alligator hunting is done. In other respects the fisheries of eastern Florida are completely exhibited.

From Table 42 it will be seen that 1,244 persons in 1889 and 1,404 in 1890 were engaged in the fishing industry, of which 1,059 and 1,168, respectively, were employed in the shore or boat fisheries. The two vessel fishermen in 1889 and the six in 1890 found employment in transporting fishery products caught by shore fishermen. The shoresmen are mostly connected with oyster-canning establishments and wholesale fish-houses.

The investment in the fisheries of eastern Florida, as shown in Table 43, was $128,434 in 1889 and $142,105 in 1890. The principal items in 1890 were $29,858 for boats, $27,730 for gill nets, $6,110 for seines, $49,919 for shore and accessory property, and $22,600 for cash capital.

The yield of the fisheries amounted to 5,982,375 pounds in 1889 and 7,463,531 pounds in 1890, for which the fishermen received $199,043 and $219,870, respectively. The increase in 1890 over the previous year was made up chiefly of mullet, shad, and oysters. Shad, the most important product, was valued at $104,283 in 1890, after which came mullet, worth $24,441; oysters, $14,850; black bass, $9,832; sheepshead, $8,358; and squeteague, $7,895. The species of fresh-water sunfishes other than black bass had a value of $20,235.

42.—Table of persons employed.

How engaged.	1889.	1890.
On vessels	2	6
In shore fisheries	1,059	1,168
On shore	183	230
Total	1,244	1,404

43.—Table of apparatus and capital.

Designation.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels transporting	1	$1,000	3	$1,750
Tonnage	10.29		39.25	
Outfit		20		260
Boats	668	28,304	716	29,858
Apparatus of capture:				
Pound nets and trap nets			5	570
Seines	86	4,685	105	6,110
Gill nets	357	25,475	468	27,730
Turtle nets	234	1,475	254	1,370
Cast nets	216	1,083	203	1,028
Lines		323		630
Tongs	52	234	50	280
Shore property		47,695		49,919
Cash capital		18,140		22,600
Total		128,434		142,105

44.—Table of products.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Alewives, fresh			10,120	$150
Black bass, fresh	155,433	$8,690	181,646	9,832
Bluefish, fresh	5,240	185	7,310	255
Bream and sunfish, fresh	497,305	17,274	588,190	20,235
Catfish, fresh	30,160	603	96,240	1,265
Channel bass, fresh	172,057	6,005	171,340	5,447
Drum, fresh	41,000	390	27,950	290
Menhaden, fresh	8,000	20		
Mullet, fresh	1,207,316	19,270	1,503,427	22,810
Mullet, salted	6,000	230	42,600	1,481
Mullet roe, salted			1,000	150
Pike, fresh	38,670	1,520	37,168	1,485
Pompano, fresh	12,434	718	30,135	1,544
Sea bass, fresh	10,800	444	10,445	355
Shad, fresh	2,051,033	98,439	2,654,022	104,283
Sheepshead, fresh	264,491	8,308	274,113	8,358
Spots and croakers, fresh	26,010	907	24,133	802
Squeteague, fresh	243,381	8,851	235,284	7,895
Sturgeon, fresh	40,620	820	28,055	560
Whiting, fresh	10,800	420	14,020	545
Miscellaneous fish, fresh	145,531	4,655	177,033	5,590
Refuse fish	443,000	2,435	520,000	2,550
Shrimps	78,000	2,805	65,825	2,557
Crabs	3,000	115	4,100	185
Oysters	*436,492	11,123	†681,450	14,850
Quahogs	‡4,800	300	§5,600	350
Terrapins	3,000	750	10,350	1,425
Turtles	45,802	3,541	60,100	4,441
Caviare	2,000	225	1,875	180
Total	5,982,375	199,043	7,463,531	219,870

* 62,356 bushels. † 97,350 bushels. ‡ 600 bushels. § 700 bushels.

THE FISHERIES CONSIDERED BY COUNTIES.

The statistics presented for this State cover 10 counties, viz: Alachua, Brevard, Clay, Dade, Duval, Nassau, Orange, Putnam, St. Johns, and Volusia. In the three tables which follow, the extent of the fisheries in each of these is shown. Duval County, which embraces the mouth and lower reaches of the St. Johns River, ranks first in importance in the three items of persons engaged, capital invested, and quantity and value of products. The other especially prominent counties are Orange and Brevard, the former an interior county, including the headwaters of the St. Johns River, the latter on the coast and embracing most of the Indian River region.

45.—Table showing by counties the number of persons employed in the fisheries of eastern Florida in 1889 and 1890.

Counties.	On vessels transporting.		In shore fisheries.		On shore.		Total.	
	1889.	1890.	1889.	1890.	1889.	1890.	1889.	1890.
Nassau		4	199	166	119	130	318	300
Duval			278	359	12	35	290	394
Clay and Putnam			132	108	12	11	144	119
Alachua			88	92	4	4	92	96
Orange			111	155	10	16	121	171
St. Johns			94	80	15	15	109	95
Volusia			56	84	4	5	60	89
Brevard	2	2	76	97	7	14	85	113
Dade			25	27			25	27
Total	2	6	1,059	1,168	183	230	1,244	1,404

46.—Table showing by counties the apparatus and capital employed in the fisheries of eastern Florida in 1889 and 1890.

Designation.	Nassau.				Duval.				Clay and Putnam.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting			2	$750								
Tonnage			28.96									
Outfit				240								
Boats	152	$5,845	139	5,151	183	$9,603	211	$9,355	55	$1,425	56	$2,890
Apparatus of capture:												
Pound nets and trap nets							1	400			1	110
Seines	9	195	9	180	14	620	13	580	1	150	2	400
Gill nets	26	590	23	580	217	19,990	245	20,895	43	2,680	21	1,160
Turtle nets												
Cast nets	21	100	19	100	94	473	100	500	18	90	13	65
Lines		15		10		35		345		14		15
Tongs	15	75	14	70	8	40	12	60				
Shore property		10,500		10,500		15,450		17,300		4,000		4,000
Cash capital		3,500		5,000		7,840		10,000		1,000		1,000
Total		20,820		22,581		54,051		59,435		9,359		9,640

Designation.	Alachua.				Orange.				St. Johns.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	54	$432	58	$484	54	$3,998	73	$5,024	56	$1,875	52	$1,410
Apparatus of capture:												
Seines	32	1,280	34	1,530	14	1,745	23	2,620	4	170	7	150
Gill nets					31	915	50	1,725	6	120	14	190
Cast nets					7	35	5	25	40	200	30	150
Lines		130		120		94		100		18		20
Tongs									13	42	5	20
Shore property		1,000		1,000		6,000		6,268		5,750		2,150
Cash capital		500		500		2,000		2,000		1,000		800
Total		3,342		3,634		14,787		17,762		9,175		4,890

Designation.	Volusia.				Brevard.				Dade.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting					1	$1,000	1	$1,000				
Tonnage					10.29		10.29					
Outfit						20		20				
Boats	43	$1,330	59	$1,994	61	3,441	57	3,170	10	$355	11	$380
Apparatus of capture:												
Pound nets and trap nets			3	60								
Seines	7	385	11	450			2	100	5	140	4	100
Gill nets	7	210	35	980	27	970	80	2,200				
Turtle nets	20	175	50	250	180	1,080	168	840	34	220	36	280
Cast nets	23	120	20	110	3	15	4	18	10	50	12	60
Lines		17		20								
Tongs	8	37	14	60	8	40	14	70				
Shore property		820		1,740		4,150		6,931		25		30
Cash capital		300		500		2,000		2,800				
Total		3,394		6,164		12,716		17,149		790		850

38.—Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia in 1889 and 1890—Continued.

Apparatus and species.	Bryan.				McIntosh.			
	1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:								
Miscellaneous fish	2,500	$100	2,970	$110				
Gill nets:								
Hickory shad	4,800	240	8,040	402	850	$43	1,100	$55
Shad	97,306	7,485	113,100	8,700	15,080	696	20,475	945
Sturgeon	33,600	600	15,120	270	25,200	540	2,860	143
Total	135,706	8,325	136,260	9,372	41,130	1,279	24,435	1,143
Cast nets:								
Mullet					4,000	260	4,180	285
Squeteague					1,120	68	1,230	81
Miscellaneous fish					1,870	112	1,960	127
Total					6,990	440	7,370	493
Fyke nets:								
Catfish	1,715	60	2,515	88				
Miscellaneous fish	1,000	40	1,675	67				
Total	2,715	100	4,190	155				
Pound nets:								
Alewives	28,000	420	16,000	240				
Catfish	19,890	560	20,070	600				
Shad			1,625	125				
Striped bass	5,060	400	4,000	320				
Total	52,950	1,380	41,695	1,285				
Lines:								
Bream and perch	6,516	300	5,004	222				
Catfish	3,949	110	3,078	96				
Channel bass					3,460	230	3,000	215
Squeteague					8,800	572	9,270	645
Miscellaneous fish	1,534	70	918	42	2,000	120	2,153	140
Total	11,999	480	9,000	360	14,260	922	14,423	1,000
Miscellaneous:								
Oysters					14,000	400	8,400	240
Terrapins					4,500	750	1,980	385
Caviare	375	60	250	40				
Total	375	60	250	40	18,500	1,150	10,380	625
Grand total	206,244	10,445	194,365	11,322	80,880	3,791	56,608	3,261

25.—*Table showing by counties, apparatus, and species the yield of the shore fisheries of Georgia in 1888 and 1889*—Continued.

Apparatus and species.	Laurens, Montgomery, Tattnall, Liberty, Pulaski, Dodge, Wilcox, Telfair, Coffee, Appling, and Wayne.				Glynn.			
	1888.		1889.		1888.		1889.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Gill nets:								
Bream and perch	4,205	$210	4,840	$242				
Channel bass					8,160	$408	7,920	$396
Hickory shad					75	8	900	45
Mullet					19,700	788	21,500	860
Shad	42,052	3,184	41,779	3,215	14,820	685	19,800	915
Squeteague					42,000	2,100	56,500	2,825
Sturgeon	5,640	28	2,800	29	8,120	232		
Suckers	4,027	199	4,493	225				
Miscellaneous fish	940	40	1,360	68	14,370	719	16,400	820
Total	56,857	3,661	55,272	3,779	107,920	4,909	117,020	5,500
Cast nets:								
Mullet					7,200	288	4,480	179
Squeteague					8,640	432	11,200	560
Miscellaneous fish					3,520	176	4,000	200
Total					19,360	896	19,680	939
Skim nets:								
Shad	57,122	4,394	56,084	4,486				
Small traps:								
Catfish	18,943	707	12,850	641				
Lines:								
Bream and perch	2,840	142	3,100	155				
Catfish	33,465	1,673	35,916	1,797				
Channel bass					3,840	192	4,000	200
Drum					3,664	73	4,000	80
Spots and croakers					3,480	174	3,000	150
Squeteague					4,200	210	4,000	200
Whiting					3,040	152	3,180	159
Miscellaneous fish					6,280	314	7,520	376
Total	36,305	1,815	39,016	1,952	24,504	1,115	25,700	1,165
Miscellaneous:								
Oysters					362,880	6,132	559,188	8,996
Shrimps					25,000	1,195	21,200	785
Crabs					1,280	64	960	48
Terrapins					1,920	265	5,640	826
Caviare					875	105		
Total					391,955	7,761	586,988	10,655
Grand total	162,227	10,577	165,222	10,831	543,739	14,741	749,388	18,320

48.—Table showing by counties, apparatus, and species the yield of the fisheries of eastern Florida in 1889 and 1890—Continued.

Apparatus and species.	Volusia.				Brevard.				Dade.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Black bass, fresh	......	......	......	......	......	......	10,040	$300	......	......	......	......
Bream and sunfish, fresh	......	......	......	......	......	......	23,113	600	......	......	......	......
Channel bass, fresh	10,320	$310	13,040	$352	......	......	......	......	3,342	$100	3,028	$90
Mullet, fresh	10,120	155	16,373	243	......	......	......	......	11,973	180	15,890	240
Pompano, fresh	......	......	......	......	......	......	......	......	2,300	161	2,050	140
Sheepshead, fresh	15,050	450	18,380	505	......	......	......	......	7,500	245	1,500	45
Squeteague, fresh	10,162	305	13,075	351	......	......	......	......	7,100	210	3,030	90
Other fish, fresh	3,780	100	4,120	110	......	......	5,022	151	3,115	90	5,500	185
Total	49,432	1,320	64,988	1,561	......	......	38,175	1,051	35,330	986	30,998	790
Gill nets:												
Bluefish, fresh	......	......	......	......	2,240	$65	3,180	95	......	......	......	......
Channel bass, fresh	5,000	150	10,980	283	54,110	1,620	35,070	1,050	......	......	......	......
Mullet, fresh	168,020	2,520	164,150	2,187	554,385	8,310	587,440	9,058	......	......	......	......
Mullet, salted	......	......	22,600	781	6,000	230	20,000	700	......	......	......	......
Mullet roe, salted	......	......	......	......	......	......	1,000	150	......	......	......	......
Pompano, fresh	......	......	......	......	10,134	557	28,085	1,404	......	......	......	......
Sheepshead, fresh	2,000	60	3,210	100	190,246	5,900	182,033	5,460	......	......	......	......
Squeteague, fresh	18,380	575	12,190	329	17,000	510	48,000	1,440	......	......	......	......
Other fish, fresh	4,620	115	4,190	101	23,815	690	31,440	930	......	......	......	......
Total	198,020	3,420	217,320	3,781	857,930	17,882	936,248	20,287	......	......	......	......
Pound nets and trap nets:												
Miscellaneous fish, fresh	......	......	2,000	48	......	......	......	......	......	......	......	......
Cast nets:												
Channel bass, fresh	......	......	......	......	1,835	55	1,927	58	1,000	30	1,360	48
Mullet, fresh	12,500	188	5,000	67	1,460	20	1,030	15	3,200	42	4,000	50
Sheepshead, fresh	......	......	......	......	850	25	1,080	32	1,800	54	2,000	60
Squeteague, fresh	......	......	......	......	1,210	45	1,145	40	3,200	96	3,060	90
Other fish, fresh	5,000	150	6,120	185	2,920	85	2,540	75	......	......	......	......
Total	17,500	338	11,120	252	8,275	230	7,722	220	9,200	222	10,420	248
Lines:												
Channel bass, fresh	5,000	150	4,300	130	......	......	......	......	......	......	......	......
Sheepshead, fresh	10,000	300	15,210	455	......	......	......	......	......	......	......	......
Squeteague, fresh	5,316	160	4,275	135	......	......	......	......	......	......	......	......
Other fish, fresh	2,730	70	3,000	72	......	......	......	......	......	......	......	......
Total	23,046	680	26,785	792	......	......	......	......	......	......	......	......
Miscellaneous:												
Shrimps	12,000	300	4,000	150	......	......	......	......	......	......	......	......
Oysters	24,360	1,740	33,950	2,425	44,100	1,890	28,000	1,550	......	......	......	......
Quahogs	800	50	800	50	......	......	......	......	......	......	......	......
Turtles	10,170	814	7,000	525	20,832	1,667	36,900	2,722	14,000	980	14,200	994
Total	47,330	2,904	45,750	3,150	64,932	3,557	64,900	4,272	14,000	980	14,200	994
Grand total	335,328	8,662	367,963	9,584	931,137	21,669	1,047,045	25,830	58,530	2,188	55,618	2,032

48.—Table showing the yield of the fisheries of eastern Florida in 1889 and 1890—Continued.

SUMMARY.

Apparatus and species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Value.
Seines:				
Black bass, fresh	77,973	$4,468	96,226	$5,268
Bream and sunfish, fresh	343,893	11,124	434.099	14,230
Channel bass, fresh	29,722	969	26,177	792
Mullet, fresh	61,316	1,002	60,881	948
Pike, fresh	28,170	1,120	26,118	1,045
Pompano, fresh	2,300	161	2,050	140
Shad, fresh	558,000	22,675	868,710	26,061
Sheepshead, fresh	22.550	695	19.880	550
Spots and croakers, fresh	14,845	402	15,020	400
Squeteague, fresh	48,372	1,527	31,339	941
Other fish, fresh	35,665	1,039	46,722	1,386
Refuse fish	427,000	2,350	460,000	2,300
Total	1,649,806	47,532	2,087,222	54.061
Gill nets:				
Bluefish, fresh	2,240	65	3,180	95
Channel bass, fresh	90,455	2.794	87,050	2,603
Mullet, fresh	1,075,760	16,930	1,398,766	20,933
Mullet, salted	6,000	230	42,600	1,481
Mullet roe, salted	....	....	1,000	150
Pompano, fresh	10.134	557	28,085	1,404
Shad, fresh	1,493,033	75,764	1,780.812	78,072
Sheepshead, fresh	215,361	6,671	204,043	6,144
Squeteague, fresh	138,728	4,848	150,430	4,779
Sturgeon, fresh	40,620	820	28,055	560
Other fish, fresh	63,635	1,975	69,698	2,164
Refuse fish	16,000	85	20,000	100
Total	3,151,966	110,739	3,813,719	118,485
Cast nets:				
Black bass, fresh	3,600	180	3,500	175
Bream and sunfish, fresh	38,280	1,483	33,440	1,171
Catfish, fresh	....	....	3,000	150
Channel bass, fresh	21,675	922	10,419	382
Menhaden, fresh	8,000	20	....	....
Mullet, fresh	70,240	1,338	43,780	929
Sheepshead, fresh	7,040	261	6,680	229
Squeteague, fresh	21,690	923	17,255	655
Other fish, fresh	24,836	896	15.588	523
Total	195,361	6,023	133,662	4,214
Pound and trap nets:				
Alewives, fresh	....	....	10,120	$150
Bream and sunfish, fresh	....	....	1,040	40
Channel bass, fresh	....	....	3,120	90
Drum, fresh	....	....	3,950	80
Shad, fresh	....	....	4,500	150
Sheepshead, fresh	....	....	4,080	120
Squeteague, fresh	....	....	3,985	120
Whiting, fresh	....	....	1,020	30
Other fish, fresh	....	....	14,900	435
Refuse fish	....	....	40,000	150
Total	....	....	86,715	1,365
Lines:				
Black bass, fresh	73,860	$4,042	81,920	4,389
Bluefish, fresh	3,000	120	4,130	160
Bream and sunfish, fresh	115,132	4,667	119,611	4,794
Catfish fresh	30,160	603	93,240	1,115
Channel bass, fresh	30,205	1,320	44,574	1,580
Drum, fresh	41,000	390	24,000	210
Pike, fresh	10,500	400	11,050	440
Sea bass, fresh	10,800	444	10,445	355
Sheepshead, fresh	19,540	681	39,430	1,315
Spots and croakers, fresh	11,165	505	9,113	402
Squeteague, fresh	34,591	1,553	32,275	1,400
Whiting, fresh	10,800	420	13,000	515
Other fish, fresh	21,395	745	30,125	1,082
Total	412,148	15,890	512,913	17,757
Miscellaneous:				
Shrimps	78,000	2,805	65,825	2,557
Crabs	3,000	115	4,100	185
Oysters	436,492	11,123	681,450	14,850
Quahogs	4,800	300	5,600	350
Terrapins	3.000	750	10,350	1,425
Turtles	45,802	3,541	60,100	4,441
Caviare	2,000	225	1,875	180
Total	573,094	18,859	829,300	23,988
Grand total	5,982,375	199,043	7,463,531	219,870

NOTES ON THE ALLIGATOR INDUSTRY.

As elsewhere explained in this article, in the inquiry on which this report is based it was not feasible to make a thorough canvass of the alligator industry, and the information at hand is only useful as showing the present condition of the business in the localities visited in connection with the regular investigation of the fisheries, and as affording a basis for an opinion of its general status throughout the State.

Florida is the only State in the South Atlantic region in which the hunting of alligators is carried on as a regular business. The industry is quite extensive, but is much less important than formerly, and in parts of the State where it was at one time a prominent business it is diminishing yearly. During the past decade the alligators have been systematically and relentlessly hunted in nearly every part of Florida; it is within bounds to say that since 1880 not less than 2,500,000 have been killed in the State, and it is not surprising that the supply has been greatly reduced in view of the non-migratory habits, the remarkably slow growth of the animal, and the sacrifice of large numbers before they have reached the reproductive age. According to the statements of hunters and others, alligators grow very slowly; during the first year of their existence they attain a length of about 1 foot; alligators 2 feet long are over 10 or 15 years old; while animals 12 feet long are 75 years old or more.

The observation of the Fish Commission agent in the St. Johns River leads him to think that the alligators are very nearly exterminated in that part of the river below Palatka, and above that point the number is becoming less year by year. Some hunters who have devoted many years to the business have given it up, and few, if any, are killing as many as they were four or five years ago. It seems only a question of time when this valuable fishery resource, which could by proper care be preserved to the State for an indefinite period, will become exhausted, to the great disadvantage of a large element of the population inhabiting the interior parts of the State.

In the Indian River region, Cocoa, Melbourne, and Fort Pierce are headquarters for alligator hunting and trade in the hides. At Cocoa about 10 men engage in hunting at times when other work does not receive attention, and in 1889 and 1890 took about 2,500 animals. In 1888 the same hunters secured 5,000 skins. A few years ago one of these hunters killed 800 alligators in a season, and another obtained 42 in one night. Twenty-five men were regularly employed in this business at one time. In 1889 and 1890, 12 hunters in the vicinity of Melbourne secured about 2,000 alligators. At Fort Pierce large numbers of alligators were handled in former years; in 1889, 12 men brought in about 4,000 skins, and in 1890, 2,000 skins and 100 otter pelts.

Near Lake Worth but little attention is given to hunting, owing to the scarcity of alligators. Only 3 men follow it regularly, in the summer months, getting from 100 to 150 animals each. In 1890 they shipped 450 hides to Jacksonville, which was about the usual yield in recent years. In 1889, 6,700 alligator hides were shipped from Miami to New York via Key West, and in 1890, 5,033 hides went from the same place.

Kissimmee, situated on Lake Tohopekaliga, in the interior of the State, is an important center of the alligator trade in the eastern half of Florida. In 1889 three firms were located there for the purpose of buying skins taken in the region between Lake Kissimmee and Lake Okeechobee, and in that year they handled 33,600 hides; in 1890 only two of these firms did business, and purchased about 15,000 skins. This decline of over 50 per cent was principally due to the scarcity of alligators, but was also influenced by the low prices received by the hunters and, to a certain extent, by the diversion of the trade from Kissimmee to Fort Myers, on the western side of the State. In 1889 about 20,000 of the skins went directly to New York and the others to Jacksonville; the following year 10,000 were sent to New York and the remainder to Jacksonville. The skins mentioned represent the work of about 20 professional and 80 semi-professional hunters. The aggregate number of animals killed and the average number to a man are very much less than the results a few years ago, when a skillful hunter could easily secure 600 alligators in two or three weeks. The marketable skins are from 3 to 12 feet in length, and are worth on an average about 60 cents apiece to the hunters, a sum which is taken out in provisions, ammunition, etc. The dealers receive 65 cents each in money from the tanners in New York.

The income of the alligator hunters in this region is considerably augmented by the capture of otters (*Lutra canadensis*), of which about 1,000 skins were sold in 1890 at an average price of $3.50 each; large numbers of other skins are also brought in, including those of the deer, bear, wildcat, opossum, and raccoon. A few years ago a large trade was also carried on in the skins and plumes of aquatic and wading birds, but the practical extermination of the birds over large areas has necessitated a discontinuance of the business.

During the past three or four years a large part of the alligator trade of Florida has been centered in Jacksonville, where, in the years covered by this inquiry, there were two firms which purchased hides and teeth from hunters and other dealers, mostly in the southern part of the State. In 1889 these firms handled about 60,000 skins and in 1890 about 20,000. In the opinion of these dealers, the noticeable decline in the business has been due to the fact that the hunters have been obtaining more remunerative employment in working the phosphate beds, and that much of the trade that formerly went through Jacksonville now goes directly to New York.

Live and stuffed alligators enter largely into the trade in Florida curiosities In Jacksonville there are 12 dealers in alligators and 18 other dealers in shells, fish-scale jewelry, alligator teeth, etc. In 1890 about 8,400 alligators were disposed of to tourists in Jacksonville. The taking of small alligators to be sold as curiosities is now a prominent feature of the business; large numbers are annually secured and disposed of at prices, varying with the season, supply, and size, ranging from $20 to $35 per hundred, although as low as $10 has at times been received. The price for stuffed alligators is about 25 cents more than for live ones. Alligators from 6 to 12 feet long bring from $12 to $14 each. It is estimated that about 450 pounds of alligator teeth were sold in 1890. Of the best teeth about 70 make a pound, but from 150 to 200 of the smaller ones are required. The teeth of alligators have some commercial value to the hunter, but in many places of late not much attention has been given to them on account of the difficulty of extracting them and the low price received ($1 to $2 per pound). They are removed by burying the head and rotting out the teeth. The stuffing of alligators and the polishing of alligator teeth give employment to about 40 persons in addition to the regular dealers.

SHORE INDUSTRIES.

At nearly all the principal fishing centers there are firms engaged in buying fishery products from the fishermen and shipping them to northern and other markets. In the lower St. Johns and the interior lake region there are also wholesale dealers in alligator hides, teeth, etc. The only shore fishery industry which requires separate notice, however, is the canning of oysters.

Two factories established for this purpose are located at Fernandina, which utilize most of the oysters taken in the vicinity of that place; these are raccoon oysters and are found mostly between high and low water. At one time most of the stock came from Nassau Sound and Bell River, but the supply has been nearly exhausted and the adjoining county in Georgia is now furnishing a large part of the product. The prices paid range from 7 to 10 cents a bushel. The oysters are put up in 5 and 10 ounce cans, packed in cases holding 4 and 3 dozen cans, respectively. The extent of this industry is shown in the following table:

49.—Table showing the extent of the oyster-canning industry of Florida in 1889 and 1890.

Items.	1889.	1890.
Number of canneries	2	2
Persons employed:		
White	18	12
Colored	101	118
Value of property	$10,000	$10,000
Cash capital	$3,500	$5,000
Oysters utilized . . . bushels	40,333	78,000
Value paid	$4,033	$7,875
Cans prepared . . . number	242,000	471,900
Value	$15,950	$35,564

VI.—FISHERIES OF THE RIVER BASINS.

GENERAL REMARKS.

In a preceding part of this report, reference has been made to the importance of the fresh-water fisheries of the South Atlantic States, and figures have been presented (Table 6) showing that the value of the products taken in fresh water is much greater than the results of the salt-water fisheries. In this chapter it is intended to discuss in greater detail this branch of the fisheries and to exhibit its importance by a series of special tables.

The occurrence of marine fishes in brackish and fresh water and of fresh-water species in brackish and salt water has necessitated a somewhat arbitrary separation of the fisheries. As a rule, all fishing for anadromous and typically fresh-water fish has been included in the accompanying tables, but the taking of salt-water products in fresh water has in most cases been disregarded; an exception being made, for instance, in St. Johns River, in the headwaters of which the capture of mullet can only be regarded as a fresh-water fishery.

In the accompanying tables the extent of the fisheries in most of the river basins of the South Atlantic States is given, the omissions consisting of a few minor streams whose commercial fisheries are unimportant or carried on by fishermen from other rivers. In the case of the rivers emptying into Albemarle Sound and Winyah Bay, it has not been deemed necessary to show separately the fisheries of the individual streams. In the former region the fishing in the sound at and around the mouths of the principal rivers can not with satisfactory accuracy be separated from that in the rivers, and the fisheries of some of the streams entering Winyah Bay are too unimportant to require individual specification.

STATISTICS OF THE RIVER FISHERIES.

The four tables which follow illustrate the extent of the fisheries of the river basins as they existed in 1889 and 1890. The tables relate to the persons employed, the boats and apparatus used, and the quantity and value of the products taken in each basin. The products are shown in two tables, one being a condensed statement of the yield of each species, the other giving the catch in the various forms of apparatus.

The fresh-water fisheries of this region gave employment to 8,343 persons in 1889, and 8,497 persons in 1890. The capital invested was $700,608 in the former year, and $720,333 in the latter. The quantity of products taken was 27,773,312 pounds in 1889, and 31,353,272 pounds in 1890, the value of the same being $766,300 and $833,165, respectively.

Most of those engaged in the industry in the fresh waters are actual fishermen. Only 705 persons in 1889 and 709 in 1890 were shoresmen and carriers, leaving 7,638 persons in 1889 and 7,788 persons in 1890 who were employed in the taking of fishery products, and all of these were shore and boat fishermen, there being no fresh-water vessel fisheries in these States.

The fishing property of the fresh waters consisted in 1890 of 24 vessels, engaged in transporting products, worth $12,555; 3,759 boats, worth $170,060; 953 pound nets, worth $81,529; 585 seines, worth $79,543; 87,557 gill nets, worth $172,832; 1,623 miscellaneous nets, worth $5,925; 1,165 pots, worth $1,755; lines worth $897; and shore and cash property valued at $195,237.

In 1890 the quantity of fresh-water fish taken was 31,353,272 pounds, for which the fishermen received $833,165. The fish of which the largest catch was made were alewives, but the yield of shad was the most valuable. The principal fishes had the following values: Shad, $482,403; alewives, $166,106; striped bass, $33,942; black bass, $30,431; sturgeon, $12,974; and catfish, $12,745.

The apparatus with which the largest catch is made is the seine, which is credited with 14,305,273 pounds, valued at $296,961. Pound nets took 8,295,677 pounds, worth $123,880. The gill-net catch was somewhat less than the pound-net, being 7,376,184 pounds, but the value was nearly three times greater. In the yield of shad and mullet the gill nets take first rank, in that of alewives and black bass the seines have precedence, and in that of striped bass the pound nets lead.

50.—Table of persons employed.

River basins.	1889.	1890.
Albemarle Sound and tributaries	*3,561	†3,550
Pamlico River	275	330
Neuse River	937	991
Cape Fear River and tributaries	445	420
Winyah Bay and tributaries	1,096	1,047
Edisto River and tributaries	314	316
Combahee, Ashepoo, and Coosawhatchie Rivers	70	65
Savannah River	170	162
Ogeechee River	116	117
Altamaha River and tributaries	698	727
St. Marys River	52	40
St. Johns River and tributaries	‡609	§732
Total	8,343	8,497

* Includes 616 shoresmen and 51 transporters.

† Includes 588 shoresmen and 55 transporters.

‡ Includes 38 shoresmen.

§ Includes 66 shoresmen.

51.—Table of vessels, boats, apparatus, etc., employed.

Items.	Albemarle Sound and tributaries.				Pamlico River.				Neuse River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Vessels transporting	23	$7,775	24	$10,650	......	......	......	......	......	......	......	......
Tonnage	210.94	......	278.17	......	......	......	......	......	......	......	......	......
Outfit	......	1,832	......	1,905	......	......	......	......	......	......	......	......
Boats	1,192	115,129	1,158	115,054	184	$5,920	209	$7,794	463	$11,995	490	$12,336
Pound nets	869	71,395	904	74,394	28	3,100	43	5,775	......	......	......	......
Seines	334	64,665	331	57,145	23	5,500	30	7,500	73	7,100	78	7,350
Gill nets	64,428	95,328	73,875	109,319	4,000	5,220	5,300	7,420	6,500	11,100	6,266	9,757
Miscellaneous nets	251	1,370	265	1,448	110	550	113	560	320	960	300	900
Pots	265	410	1,070	1,615	25	40	95	140	......	......	......	......
Shore property	......	112,455	......	110,801	......	5,484	......	5,675	......	800	......	820
Cash capital	......	36,500	......	30,100	......	......	......	......	......	......	......	......
Total	......	506,859	......	512,431	......	25,814	......	34,864	......	31,955	......	31,163

Items.	Cape Fear River and tributaries.				Winyah Bay and tributaries.				Edisto River and tributaries.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	190	$2,495	195	$2,615	659	$9,229	614	$8,797	109	$2,316	122	$2,572
Seines	55	1,506	55	1,506	9	485	9	485	16	700	17	760
Gill nets	127	3,586	109	3,455	568	13,721	506	9,911	928	2,086	804	2,535
Miscellaneous nets	63	203	64	208	252	963	255	831	151	403	145	388
Lines	......	4	......	4	......	71	......	74	......	11	......	10
Shore property	......	397	......	463	......	......	......	......	......	1,125	......	1,200
Total	......	8,191	......	8,191	......	24,469	......	20,098	......	6,641	......	7,525

51.—Table of vessels, boats, apparatus, etc., employed—Continued.

Items.	Combahee, Ashepoo, and Coosawhatchie rivers.				Savannah River.				Ogeechee River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	31	$335	38	$420	105	$1.528	98	$1.367	67	$990	66	$910
Pound nets									5	1,250	5	1.250
Seines									1	12	1	12
Gill nets	22	610	26	730	102	2.994	93	2.786	70	2.465	77	2.775
Miscellaneous nets	24	52	25	55	77	384	72	409	2	10	3	15
Lines		9		8		158		160		8		6
Shore property		400		500		50		50		3,500		3,620
Total		1.406		1.713		5,114		4,772		8,235		8,588

Items.	Altamaha River and tributaries.				St. Marys River.				St. Johns River and tributaries.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.	No.	Value.
Boats	361	$1,353	377	$1,212	26	$315	20	$240	320	$14,318	372	$16,743
Pound nets											1	110
Seines									50	3,310	64	4.785
Gill nets	184	960	191	939	26	590	20	460	265	21,845	290	22.685
Miscellaneous nets	341	933	351	961					37	185	30	150
Lines		77		85						248		550
Shore property										26,450		28,568
Cash capital										11,340		13.500
Total		3,323		3.197		905		700		77.696		87,091

SUMMARY.

Items.	1889.		1890.	
	No.	Value.	No.	Value.
Vessels transporting	23	$7,775	24	$10,650
Tonnage	210.94		278.17	
Outfit		1,832		1,905
Boats	3,707	165,923	3,759	170,060
Pound nets	902	75.745	953	81,529
Seines	561	83,278	585	79.543
Gill nets	77,220	160,505	87,557	172,832
Miscellaneous nets	1.628	6,013	1,623	5,925
Pots	290	450	1,165	1,755
Lines		586		897
Shore property		150,661		151,637
Cash capital		47.840		43,600
Total		700,608		720.333

52.—Table of products and values.

Species.	Albemarle Sound and tributaries.				Pamlico River.				Neuse River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives	13,477,340	$135,415	15,273,573	$151,567	461,800	$5,726	538,400	$6,730	447,660	$4.242	669,090	$6,339
Black bass	397,470	19.790	386,090	19.206					22.700	1.362	21,440	1,286
Bream and perch	422,155	15,859	414,745	15,492	121,518	4.472	157,279	5,611	16,000	480	15,000	450
Catfish	19,420	583	21,685	651					27.200	408	25,000	375
Eels	53.950	3,398	155.700	9,414	1,300	78	4,915	312				
Pike	27,261	1,308	32,010	1,545					9,500	250	8.500	220
Shad	4,053,765	205.905	4.348.350	231,756	393,080	21.478	434.911	23.742	558.500	31.460	647,336	31.812
Strawberry bass	29.725	1,153	28.075	1,106								
Striped bass	434.750	24.006	476.444	25,907	39,099	2,155	37.217	1.997	57.500	4.450	54.680	4.234
Sturgeon	128.097	3.742	118.085	3,467					27.200	272	26.500	265
Other fish	167.272	5,361	186,515	5.948	19,776	610	19.235	573	56,000	810	58,872	840
Refuse fish	17,220	160	18.500	173								
Total	19,228,425	416.680	21,459.772	466.232	1,036,573	34,519	1.191.957	38,965	1,222,260	43.734	1,526.418	45.821

52.—*Table of products and values*—Continued.

Species.	Cape Fear River and tributaries.				Winyah Bay and tributaries.				Edisto River and tributaries.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives					37,160	$939	28,600	$740				
Black bass					1,995	100	2,100	107				
Bream and perch	23,294	$1,187	22,450	$1,216	76,697	3,622	76,720	3,618	17,130	$986	16,350	$975
Catfish	8,600	257	7,000	220	67,963	2,106	65,827	2,047				
Hickory shad					35,230	1,094	26,308	830	7,220	353	7,424	371
Shad	351,041	21,355	337,816	18,705	399,069	29,987	385,364	28,197	129,434	8,705	127,933	8,609
Striped bass					3,000	240	2,800	224	7,295	720	8,360	820
Sturgeon	72,500	1,740	30,625	735	211,375	2,619	123,512	2,867	18,800	400	32,500	1,022
Suckers	58,146	1,745	60,550	1,779	24,796	1,044	26,558	1,097	23,797	1,213	23,314	1,180
Other fish	1,900	45	2,300	52	50,282	2,014	50,580	1,998	12,855	503	13,645	547
Total	515,481	26,329	460,741	22,707	907,567	43,765	788,369	41,725	216,591	12,880	229,526	13,524

Species.	Combahee, Ashepoo, and Coosawhatchie rivers.				Savannah River.				Ogeechee River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives					8,000	$300	8,000	$340	28,000	$420	16,000	$240
Bream and perch	8,300	$461	9,765	$516	7,930	392	7,256	363	6,516	300	5,004	222
Catfish	5,100	100	5,620	115	99,915	5,074	93,291	4,850	25,554	730	25,663	784
Hickory shad	468	20	505	25	8,800	440	8,500	380	8,000	400	12,600	670
Shad	36,026	2,505	38,496	2,980	80,108	7,230	80,863	8,153	160,095	12,315	190,125	14,625
Striped bass	490	50	400	40	8,200	700	5,000	400	5,060	400	4,000	320
Sturgeon	29,975	975	41,187	1,521	142,545	3,326	71,350	1,704	56,375	1,060	25,450	490
Suckers					1,675	100	1,430	86				
Other fish	4,800	384	9,800	584	9,127	562	9,290	583	5,034	210	5,563	219
Total	85,159	4,495	105,773	5,781	366,300	18,124	284,980	16,859	294,634	15,835	284,405	17,570

Species.	Altamaha River and tributaries.*				St. Marys River.				St. Johns River and tributaries.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Alewives											10,120	$150
Black bass									155,433	$8,690	181,646	9,832
Bream and perch	7,045	$352	7,940	$398					497,305	17,274	588,190	20,235
Catfish	47,408	2,380	48,766	2,438					30,160	603	96,240	1,265
Hickory shad	1,600	81	2,000	100								
Mullet									408,993	6,818	684,616	10,208
Pike									38,670	1,520	37,168	1,485
Shad	129,077	8,954	140,138	9,541	60,000	$3,000	37,800	$1,890	1,991,033	95,439	2,616,222	102,393
Sturgeon	37,835	903	5,660	163	39,500	975	27,930	695	3,120	70	2,000	45
Suckers	4,017	199	4,493	225								
Other fish	940	46	1,360	69					5,186	200	9,042	299
Refuse fish									443,000	2,435	520,000	2,550
Total	227,922	12,915	210,357	12,934	99,500	3,975	65,730	2,585	3,572,900	133,049	4,745,244	148,462

* Includes the Satilla River.

SUMMARY.

Species.	1889.		1890.	
	Pounds.	Value.	Pounds.	Values.
Alewives	14,459,960	$147,042	16,543,783	$166,106
Black bass	577,598	29,942	591,276	30,431
Bream and perch	1,203,890	45,385	1,320,699	49,096
Catfish	331,320	12,241	389,092	12,745
Eels	55,250	3,476	160,615	9,726
Hickory shad	61,318	2,388	57;337	2,376
Mullet	408,993	6,818	684,616	10,208
Pike	75,431	3,078	77,678	3,250
Shad	8,341,228	448,333	9,385,354	482,403
Strawberry bass	29,725	1,153	28,075	1,106
Striped bass	555,394	32,721	588,901	33,942
Sturgeon	767,382	16,082	504,799	12,974
Suckers	112,431	4,301	116,345	4,367
Other fish	333,172	10,745	366,202	11,712
Refuse fish	460,220	2,595	538,500	2,723
Total	27,773,312	766,300	31,353,272	833,165

53.—Table of products specified by apparatus.

Apparatus and species.	Albemarle Sound and tributaries.				Pamlico River.				Neuse River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pound nets:												
Alewives	5,996,880	$60,920	7,073,584	$69,295	76,280	$955	115,840	$1,451				
Black bass	10,650	426	11,800	472								
Bream and perch	199,760	8,840	189,780	8,437	30,400	1,216	36,485	1,319				
Catfish	7,420	223	7,685	231								
Eels	7,050	494	7,200	504								
Pike	900	40	1,100	49								
Shad	362,276	20,386	379,558	21,175	23,241	1,262	24,801	1,338				
Strawberry bass	1,450	70	1,645	80								
Striped bass	240,221	13,732	260,464	14,874								
Sturgeon	1,720	34	1,500	30								
Other fish	60,347	2,059	79,585	2,635	5,216	158	7,295	215				
Total	6,888,674	107,224	8,013,901	117,782	135,137	3,591	184,421	4,323				
Seines:												
Alewives	7,344,160	73,018	8,061,149	80,756	385,520	4,771	422,560	5,279	447.660	$4,242	669,090	$6,339
Black bass	386,820	19,364	374,290	18,734					9,500	570	8,000	480
Bream and perch	199,595	6,455	196,665	6,335	91,118	3,256	120,794	4,292	9,500	285	9,000	270
Catfish	12,000	360	14,000	420					27,200	408	25,000	375
Pike	26,361	1,268	30,910	1,496					5,500	170	5,000	150
Shad	1,195,240	56,602	1,085,516	58,923	172,564	9,654	195,297	10,894	157,500	9,000	478,976	22,960
Strawberry bass	28,275	1,083	26,430	1,026								
Striped bass	131,650	5,702	142,570	5,868	36,616	2,010	36,017	1,930	52,500	4,200	50,000	4,000
Sturgeon	41,552	378	37,185	349					27,200	272	26,500	265
Other fish	99,125	3,122	99,060	3,136	11,565	362	10,185	305	33,000	580	33,872	590
Refuse fish	17,220	160	18,500	173								
Total	9,481,998	166,512	10,086,275	177,226	697,383	20,053	784,853	22,700	769,560	19,727	1,305,438	35,429
Gill nets:												
Alewives	65,800	639	64,040	632								
Black bass									13,200	792	13,440	806
Bream and perch	22,800	564	28,300	720					6,500	195	6,000	180
Pike									4,000	80	3,500	70
Shad	2,461,774	127,197	2,846,841	149,576	114,800	6,262	129,500	7,050	355,500	19,860	128,360	6,552
Striped bass	61,629	4,497	72,100	5,086	2,483	145	1,200	67	5,000	250	4,680	234
Sturgeon	84,825	3,330	79,400	3,088								
Other fish	6,800	153	6,270	137	2,995	90	1,755	53	23,000	230	25,000	250
Total	2,703,628	136,380	3,096,951	159,239	120,278	6,497	132,455	7,170	407,200	21,407	180,980	8,092
Miscellaneous nets:												
Alewives	70,500	838	74,800	884								
Shad	34,475	1,720	36,435	2,082	82,475	4,300	85,313	4,460	45,500	2,600	40,000	2,300
Striped bass	1,250	75	1,310	79								
Other fish	1,000	27	1,600	40								
Total	107,225	2,660	114,145	3,085	82,475	4,300	85,313	4,460	45,500	2,600	40.000	2,300
Pots:												
Eels	46,900	2,904	148,500	8,910	1,300	78	4,915	312				
Grand total	19,228,425	416,680	21,459,772	466,232	1,036,573	34,519	1,191,957	38,965	1,222,260	43,734	1,526,418	45,821

53.—Table of products specified by apparatus—Continued.

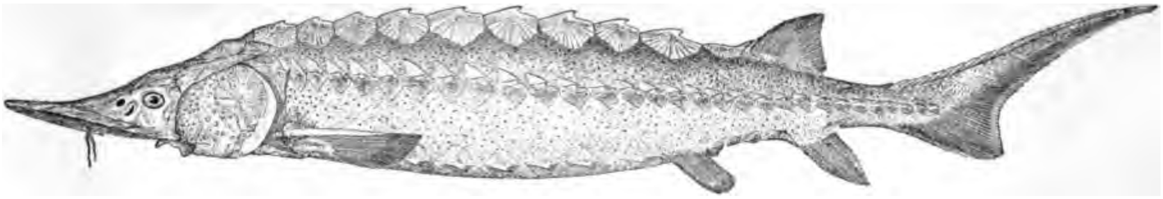
Apparatus and species.	Cape Fear River and tributaries.				Winyah Bay and tributaries.				Edisto River and tributaries.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Seines:												
Bream and perch	13,460	$704	11,450	$671					2,980	$238	3,020	$241
Catfish					4,135	$124	3,027	$91				
Hickory shad					2,048	99	2,200	110	3,360	160	3,424	171
Shad	93,494	6,324	84,940	5,680	7,918	789	7,251	654	17,570	1,551	18,538	1,591
Striped bass									5,495	540	6,300	620
Sturgeon					3,200	95	2,762	82	4,860	150	4,500	145
Suckers	53,080	1,542	55,150	1,584	2,981	149	3,140	157	1,802	108	1,635	98
Other fish					1,337	59	780	30	2,080	130	2,445	151
Total	160,034	8,570	151,540	7,935	21,619	1,315	19,160	1,124	38,147	2,877	39,862	3,017
Gill nets:												
Black bass					1,995	100	2,100	107				
Bream and perch	1,000	50	1,000	50	10,297	451	9,620	415	10,800	540	10,320	532
Hickory shad					33,182	995	24,108	720	3,860	193	4,000	200
Shad	247,747	14,151	243,876	12,210	292,744	21,623	282,096	20,025	101,100	6,160	100,100	6,160
Striped bass									1,800	180	2,060	200
Sturgeon	72,500	1,740	30,625	735	208,175	2,524	120,750	2,785	14,000	250	28,000	877
Suckers	1,200	48	1,400	55	10,940	460	12,368	498	21,995	1,105	21,679	1,082
Other fish	900	25	800	22	5,950	238	7,250	266	10,775	373	11,200	396
Total	323,347	16,014	277,701	13,072	563,283	26,391	458,292	24,816	164,330	8,801	177,359	9,447
Miscellaneous nets:												
Alewives					37,160	939	28,600	740				
Bream and perch	3,834	183	5,000	245								
Catfish	3,800	112	3,000	90	4,840	145	3,400	102				
Shad	9,800	880	9,000	815	98,407	7,575	96,017	7,518	10,764	994	9,295	858
Striped bass					3,000	240	2,800	224				
Suckers	3,866	155	4,000	140	10,875	435	11,050	442				
Other fish					4,420	176	3,210	128				
Total	21,300	1,330	21,000	1,290	158,702	9,510	145,077	9,154	10,764	994	9,295	858
Lines:												
Bream and perch	5,000	250	5,000	250	66,400	3,171	67,100	3,203	3,350	208	3,010	202
Catfish	4,800	145	4,000	130	58,988	1,837	59,400	1,854				
Other fish	1,000	20	1,500	30	38,575	1,541	39,340	1,574				
Total	10,800	415	10,500	410	163,963	6,549	165,840	6,631	3,350	208	3,010	202
Grand total	515,481	26,329	460,741	22,707	907,567	43,765	788,369	41,725	216,591	12,880	229,526	13,524

Apparatus and species.	Combahee, Ashepoo, and Coosawhatchie rivers.				Savannah River.				Ogeechee River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds,	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pound nets:												
Alewives									28,000	$420	16,000	$240
Catfish									19,890	560	20,070	600
Shad											1,625	125
Striped bass									5,060	400	4,000	320
Total									52,950	1,380	41,695	1,285
Seines:												
Miscellaneous fish									2,500	100	2,970	110
Gill nets:												
Bream and perch	300	$21	265	$18	1,106	$70	1,800	$95				
Hickory shad	468	20	505	25	8,800	440	8,500	380	8,000	400	12,600	670
Shad	30,501	2,065	31,996	2,465	78,288	7,006	79,238	7,953	160,095	12,315	188,500	14,500
Sturgeon	29,975	975	41,187	1,521	142,545	3,326	71,350	1,704	56,375	1,060	25,450	490
Other fish	4,800	384	9,800	584	5,880	367	5,930	375				
Total	66,044	3,465	83,753	4,613	236,619	11,209	166,818	10,507	224,470	13,775	226,550	15,660

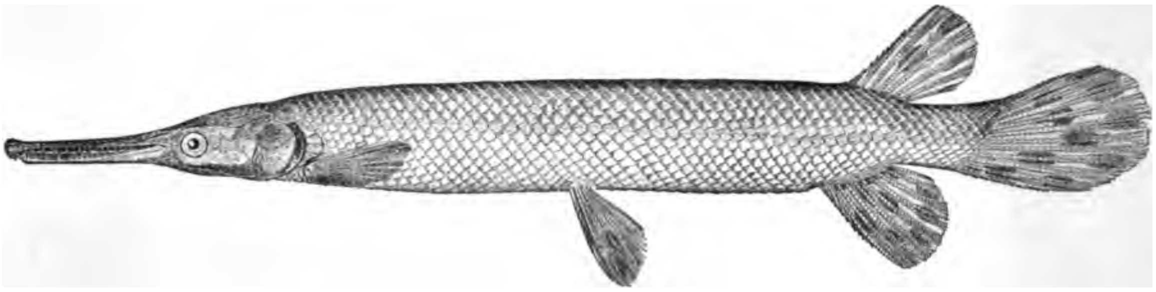
53.—*Table of products specified by apparatus*—Continued.

Apparatus and species.	Combahee, Ashepoo, and Coosawhatchie rivers.				Savannah River.				Ogeechee River.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Miscellaneous nets:												
Alewives					8,000	$300	8,000	$340				
Bream and perch					2,480	124	2,120	120				
Catfish	5,100	$100	5,620	$115	20,125	999	17,892	938	1,715	$60	2,515	$88
Shad	5,525	440	6,500	515	1,820	224	1,625	200				
Striped bass	490	50	400	40	6,000	480	3,000	240				
Suckers					1,675	100	1,430	86				
Other fish					2,357	140	2,560	158	1,000	40	1,675	67
Total	11,115	590	12,520	670	42,457	2,367	36,627	2,082	2,715	100	4,190	155
Lines:												
Bream and perch	8,000	440	9,500	498	4,344	198	3,336	148	6,516	300	5,004	222
Catfish					79,790	4,075	75,399	3,912	3,949	110	3,078	96
Striped bass					2,200	220	2,000	160				
Other fish					890	55	800	50	1,534	70	918	42
Total	8,000	440	9,500	498	87,224	4,548	81,535	4,270	11,999	480	9,000	360
Grand total	85,159	4,495	105,773	5,781	366,300	18,124	284,980	16,859	294,634	15,835	284,405	17,570

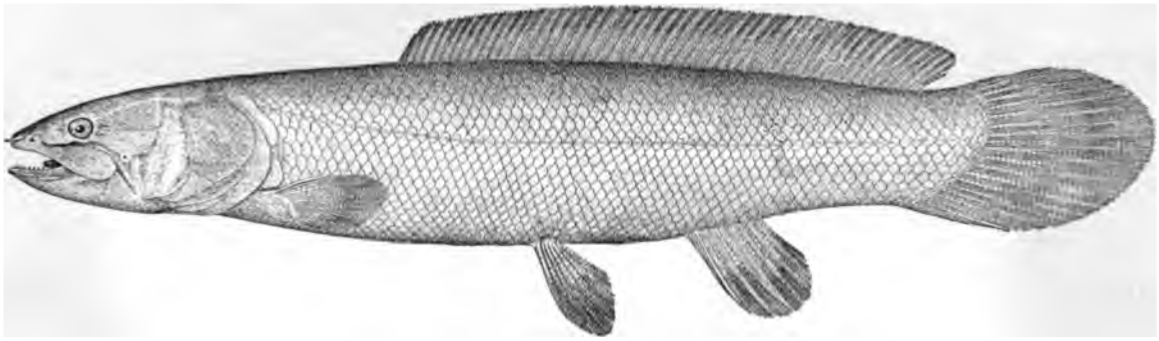
Apparatus and species.	Altamaha River and tributaries.				St. Marys River.				St. Johns River and tributaries.			
	1889.		1890.		1889.		1890.		1889.		1890.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pound nets:												
Alewives											10,120	$150
Bream and perch											1,040	40
Shad											4,500	150
Refuse fish											40,000	150
Total											55,660	490
Seines:												
Black bass									77,973	$4,468	96,226	5,268
Bream and perch									343,893	11,124	434,099	14,230
Mullet									31,723	480	25,000	375
Pike									28,170	1,120	26,118	1,045
Shad									558,000	22,675	868,710	26,061
Other fish											5,022	151
Refuse fish									427,000	2,350	460,000	2,300
Total									1,466,759	42,217	1,915,175	49,430
Gill nets:												
Bream and perch	4,205	$210	4,840	$243								
Hickory shad	1,600	81	2,000	100								
Mullet									346,000	5,880	644,176	9,598
Shad	71,955	4,560	82,054	5,073	60,000	$3,000	37,800	$1,890	1,433,033	72,764	1,743,012	76,182
Sturgeon	37,835	903	5,660	163	39,500	975	27,930	695	3,120	70	2,000	45
Suckers	4,017	199	4,493	225								
Other fish	940	46	1,360	69								
Refuse fish									16,000	85	20,000	100
Total	120,552	5,999	100,407	5,873	99,500	3,975	65,730	2,585	1,798,153	78,799	2,409,168	85,925
Miscellaneous nets:												
Black bass									3,600	180	3,500	175
Bream and perch									38,280	1,483	33,440	1,171
Catfish	13,943	707	12,850	641							3,000	150
Mullet									31,270	458	15,440	235
Shad	57,122	4,394	58,064	4,468								
Other fish									5,186	200	4,020	148
Total	71,065	5,101	70,934	5,109					78,336	2,321	59,400	1,879
Lines:												
Black bass									73,860	4,042	81,920	4,389
Bream and perch	2,840	142	3,100	155					115,132	4,667	119,611	4,794
Catfish	33,465	1,673	35,916	1,797					30,160	603	93,240	1,115
Pike									10,500	400	11,050	440
Total	36,305	1,815	39,016	1,952					229,652	9,712	305,821	10,738
Grand total	227,922	12,915	210,357	12,934	99,500	3,975	65,730	2,585	3,572,900	133,049	4,745,244	148,462



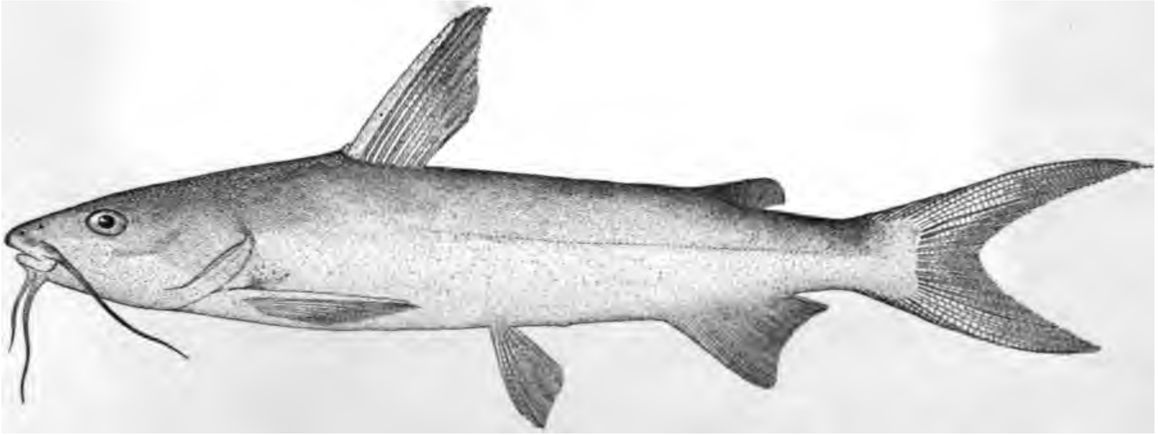
ACIPENSER STURIO OXYRHYNCHUS (Mitchill). *Sturgeon.*



LEPISOSTEUS PLATYSTOMUS Rafinesque. *Short-nosed gar.* Gar.

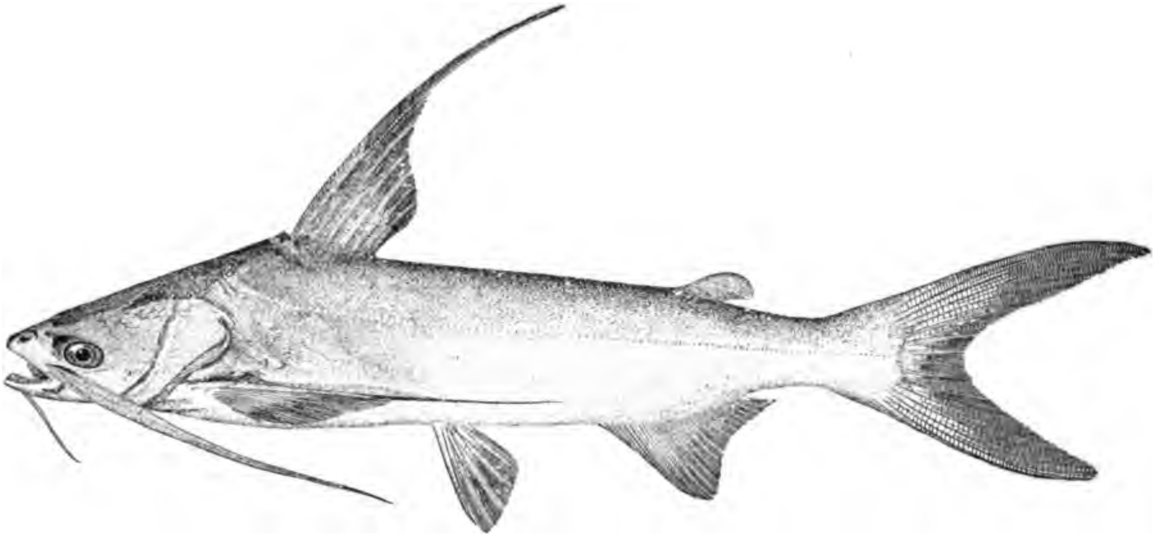


AMIA CALVA Linnæus. ***Dogfish; Mudfish.*** Grindle; Mudfish; Blackfish (N. C.).

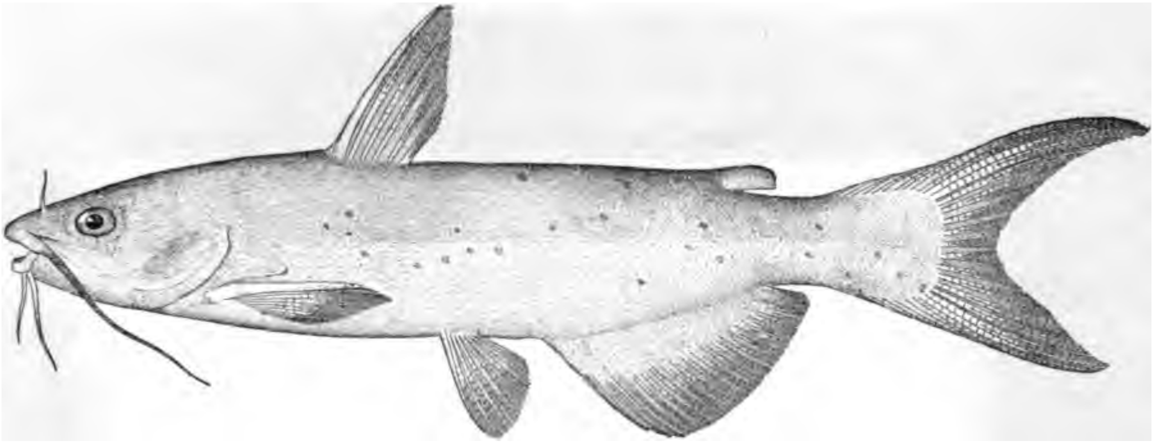


TACHYSURUS FELIS (Linnæus). ***Sea catfish.*** **Small-mouthed cat (S. C.).**

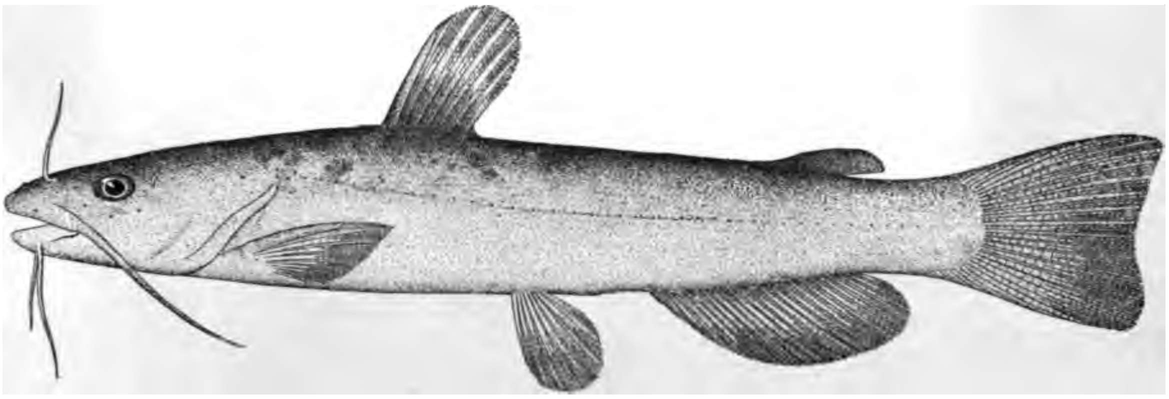
PLATE XLIV.



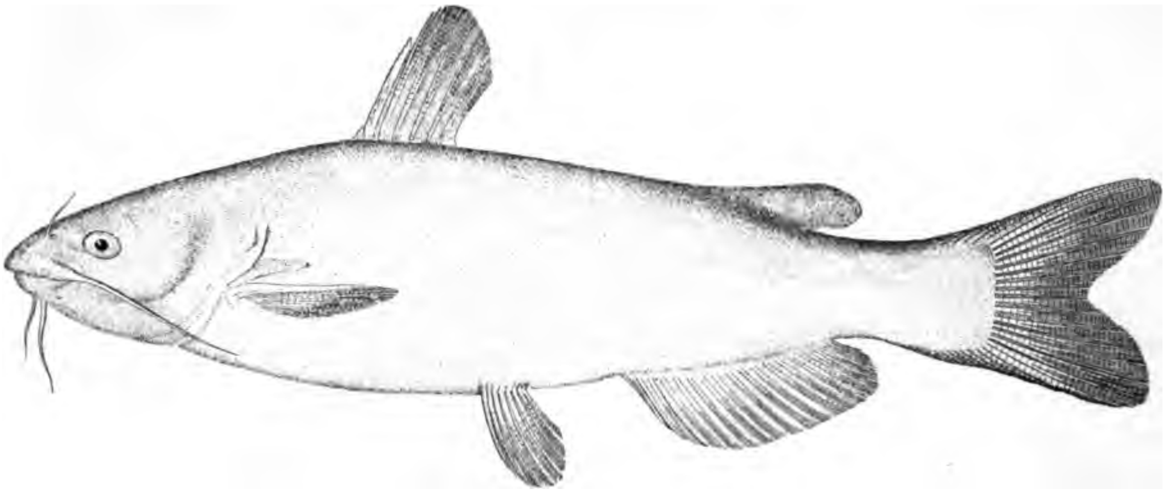
AILURICHTHYS MARINUS (Mitchill). *Sea catfish.* Silver cat (N. C.); Large mouthed cat (S. C.); Gaff topsail (Ga.); Sea cat (Fla.).



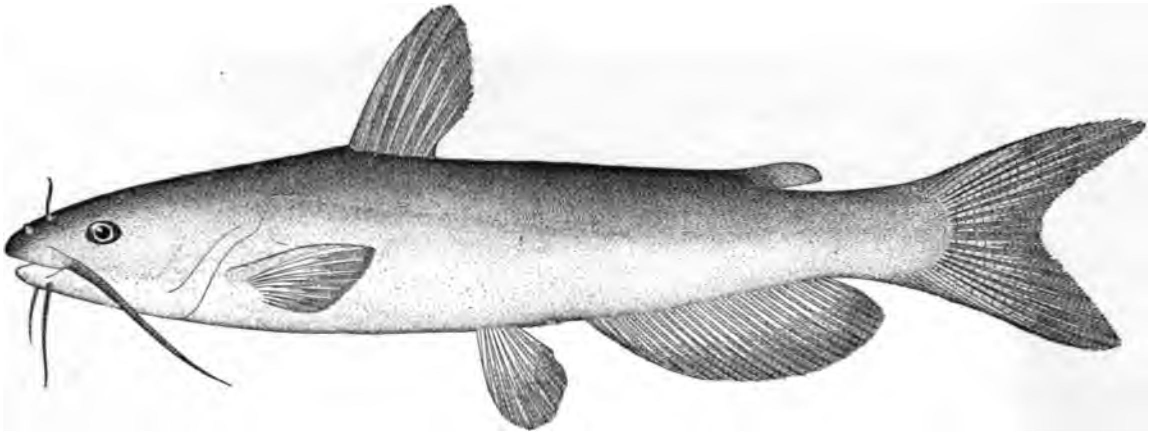
ICTALURUS PUNCTATUS (Rafinesque). *Channel catfish ; Spotted catfish.* Channel cat (S. C., Fla.); Small-mouthed cat (Fla.).



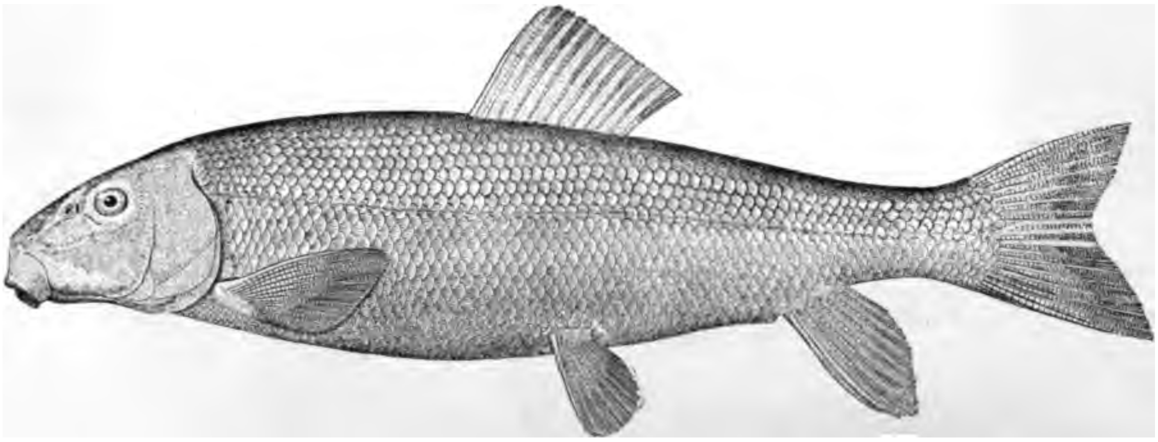
AMEIURUS PLATYCEPHALUS (Girard). Mud cat (S. C.).



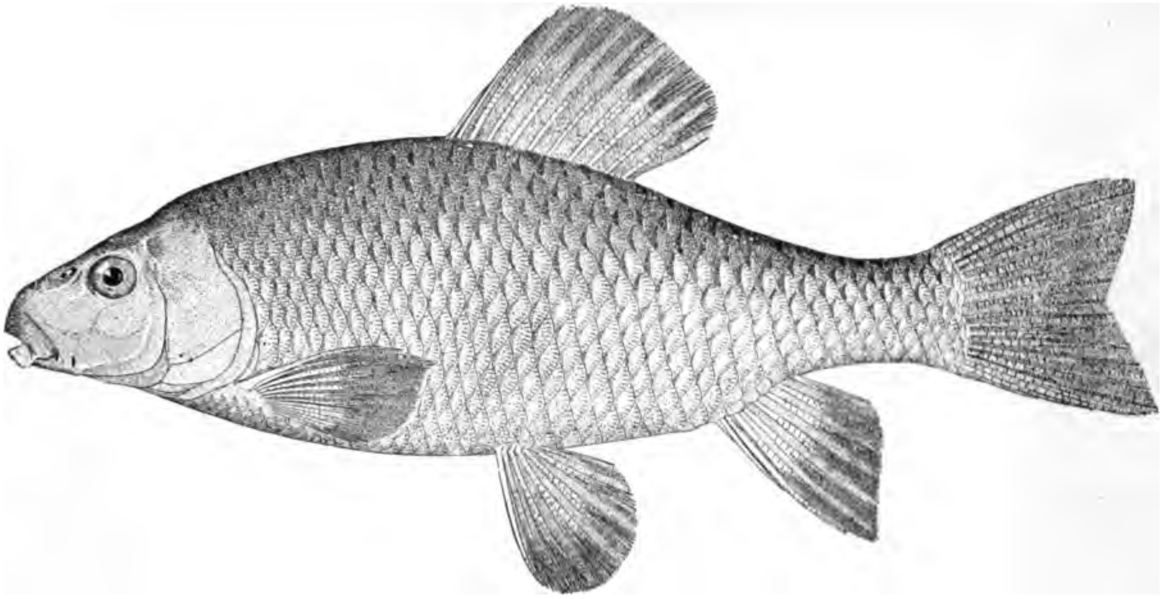
AMEIURUS ALBIDUS (Le Sueur). *White catfish.* White cat (N. C.); Black cat (N. C.); Bullhead (N. C.).



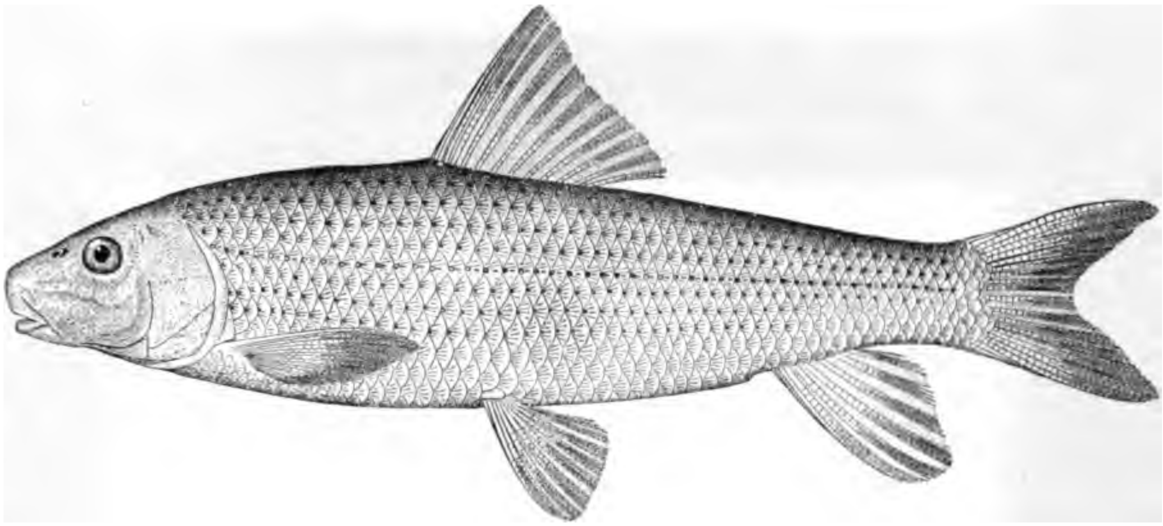
AMEIURUS NIGRICANS (Le Sueur). *Great catfish; Florida catfish.* Mud cat (Fla.).



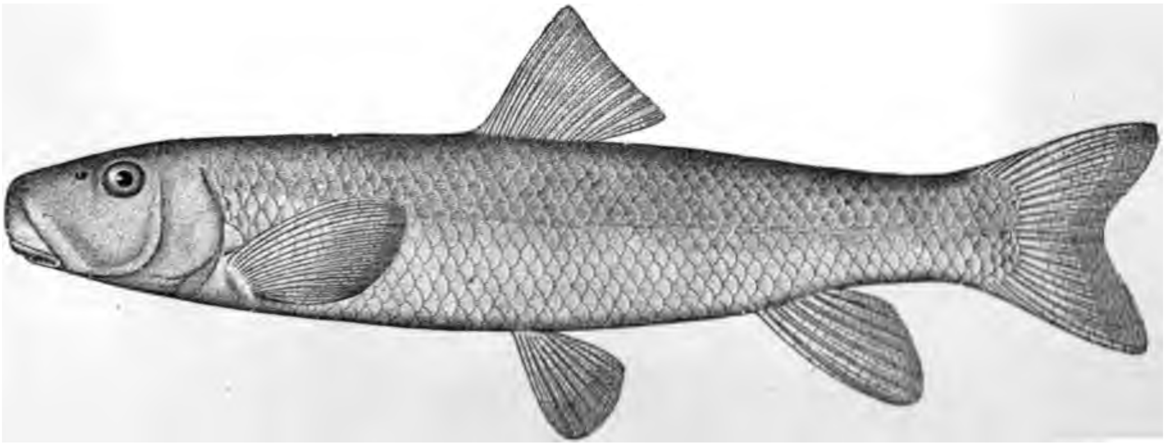
CATOSTOMUS TERES (Mitchill). ***Common sucker.*** **Sucker; Fine-scaled su**



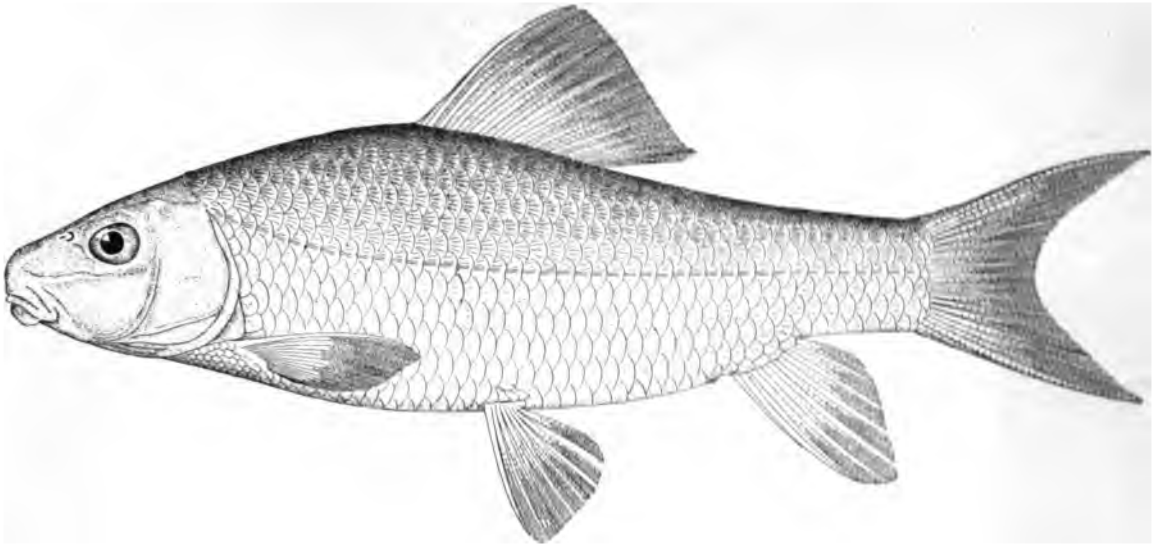
ERIMYZON SUCETTA (Lacépède). *Chub sucker.* Sucker.



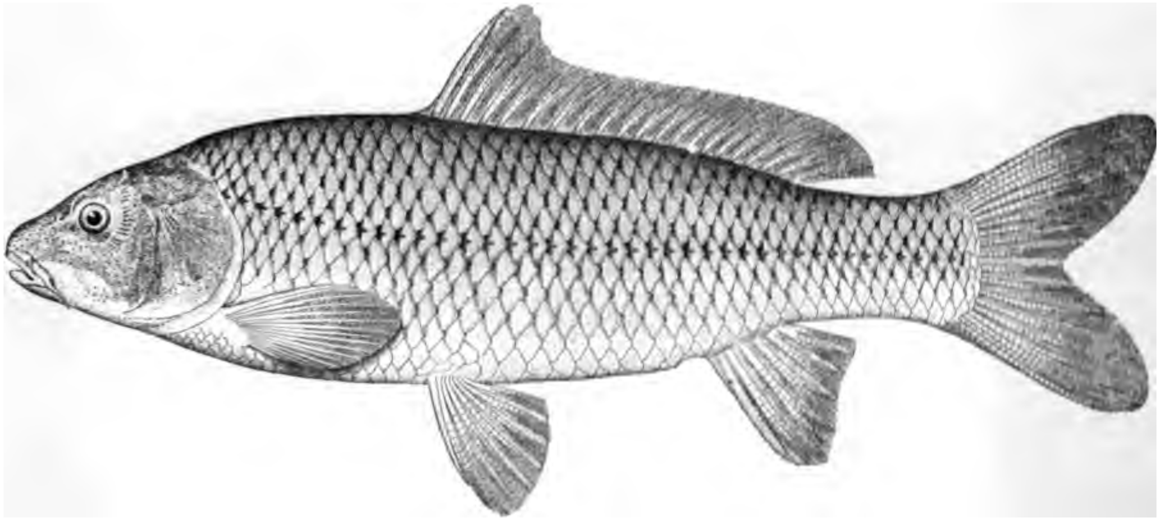
MINYTREMA MELANOPS (Rafinesque). *Striped sucker.* **Black winter sucker (N. C.); Striped sucker (S. C.); Spotted sucker (S. C.).**



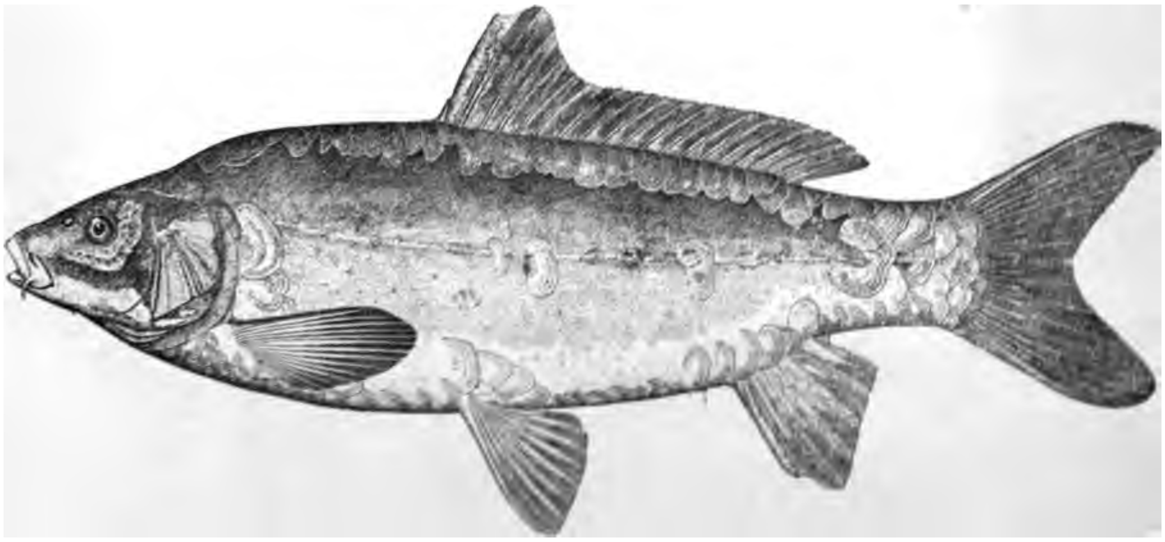
MOXOSTOMA RUPISCARTES Jordan and Jenkins. ***Sucker.*** **Jump-rocks. (A closely related species, *M.* "jump-rocks" and "jumping mullet.")**



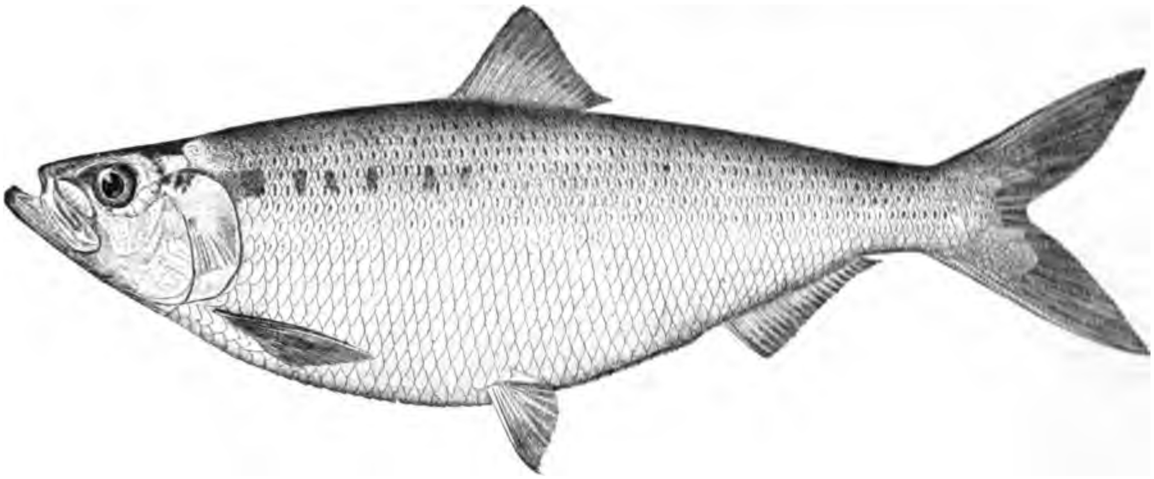
MOXOSTOMA PAPILLOSUM (Cope). *Sucker.* White mullet (Ga.); White sucker (Ga.); Shiner (Ga.). (A number of similar suckers occur throughout the South Atlantic region and are known to the fishermen as "mullet," redhorse," etc.)



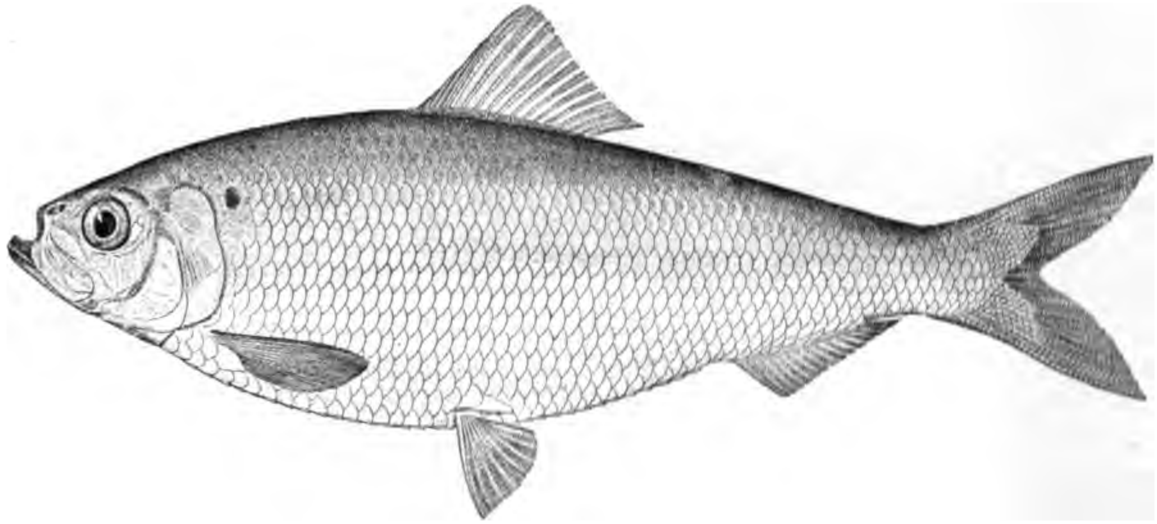
CYPRINUS CARPIO Linnæus. *Asiatic carp; Scale carp.*



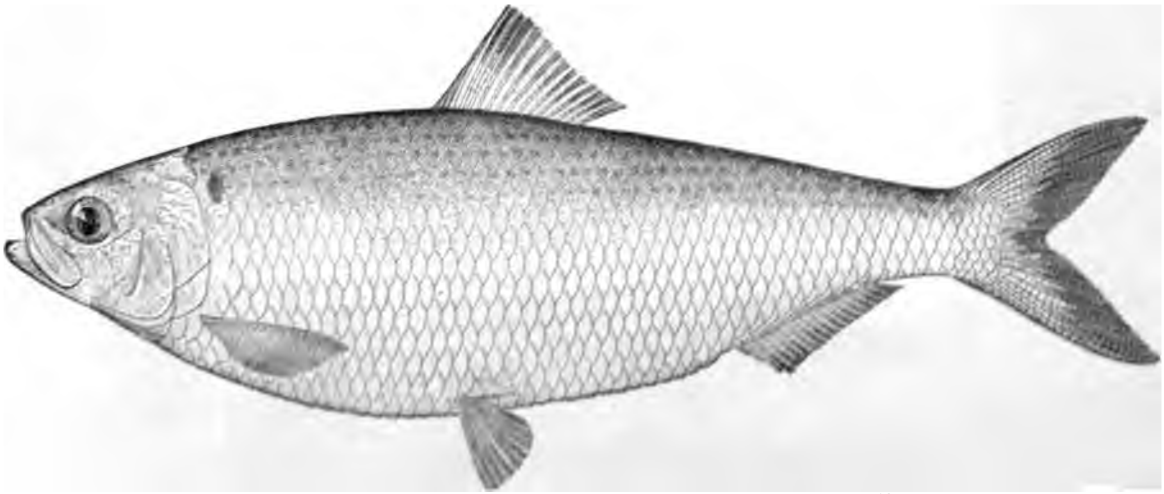
CYPRINUS CARPIO CORIACEUS (Lacépède). *Leather carp.*



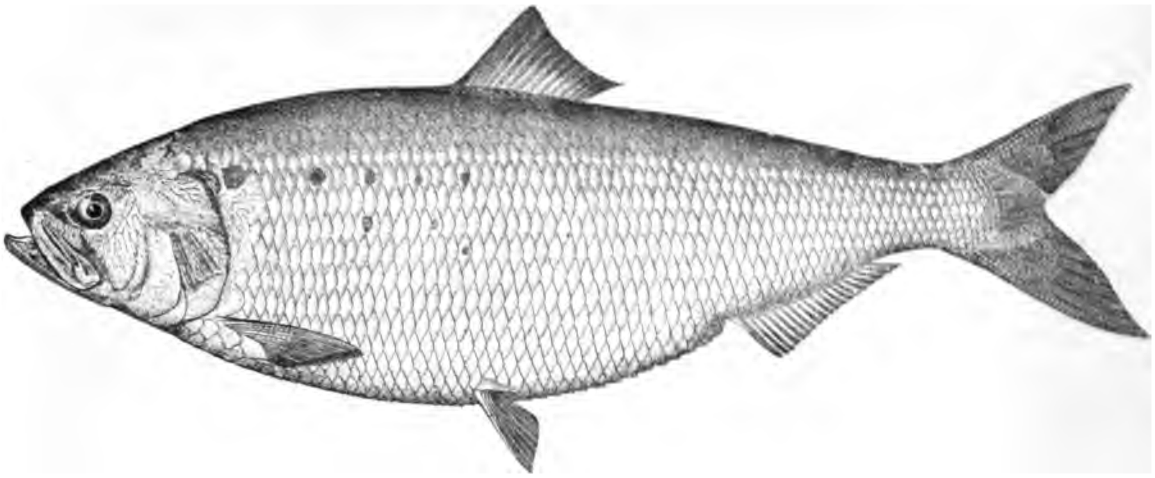
CLUPEA MEDIOCRIS Mitchill. *Hickory shad.* Hickory shad; Hick; Jack (N. C.).



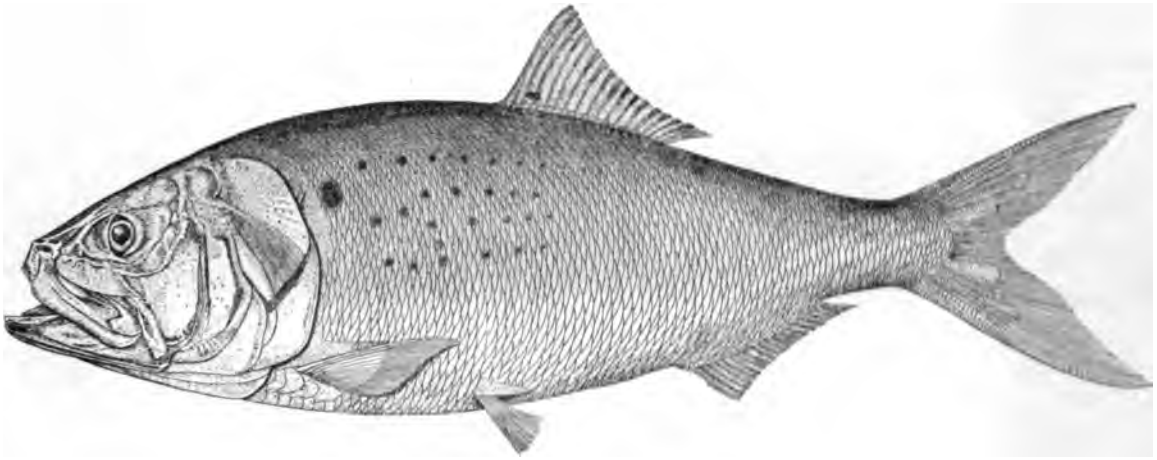
CLUPEA PSEUDOHARENGUS Wilson. *Alewife; Branch herring.* Herring; Goggle-eye (N. C.); Big-eyed herring (N. C.); **Wall-eyed herring (N. C.).**



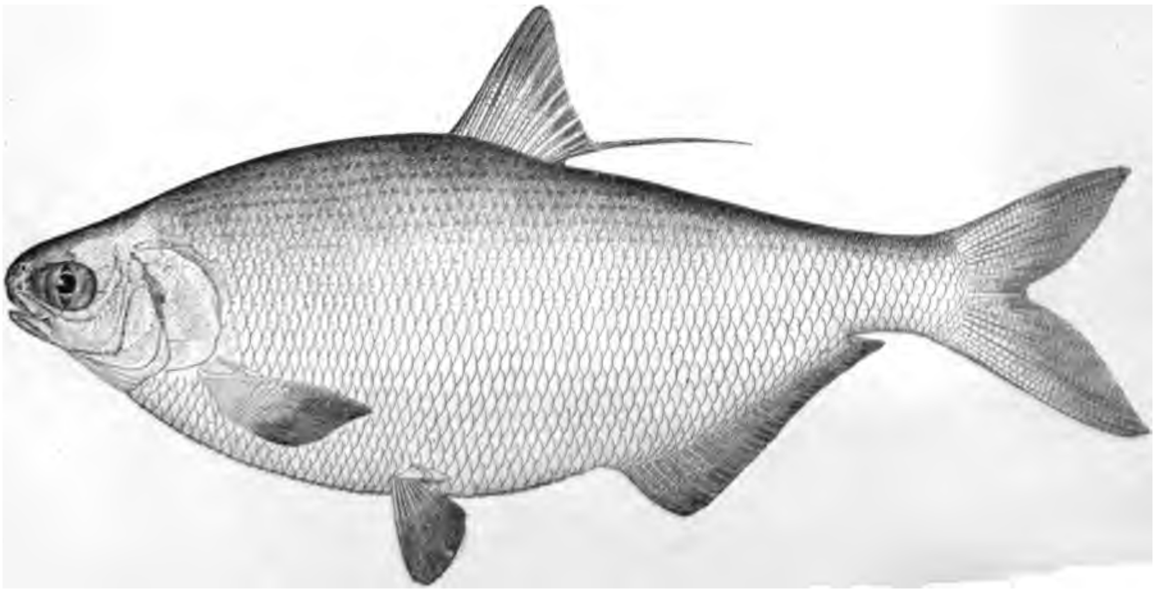
CLUPEA ÆSTIVALIS Mitchill. ***Alewife; Glut herring.*** **Herring; Blueback (N. C.); May herring (N. C.); School herring English herring (S. C.).**



CLUPEA SAPIDISSIMA Wilson. *Shad.*

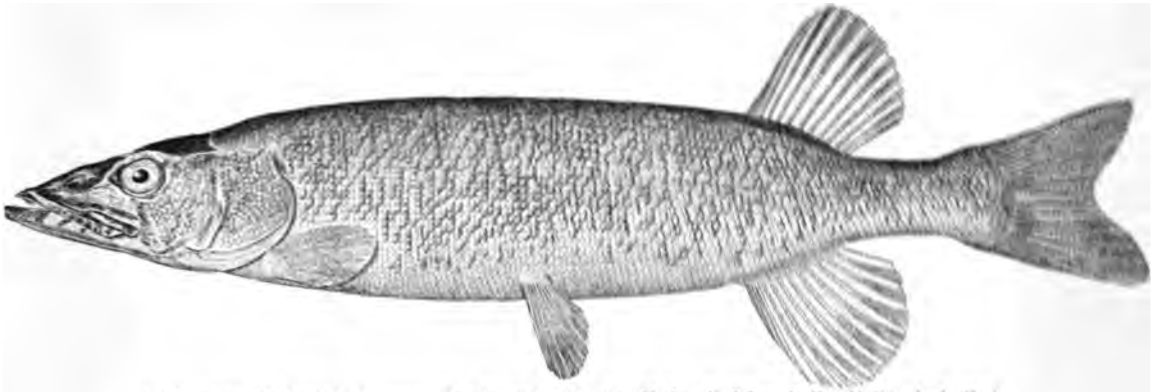


BREVOORTIA TYRANNUS (Latrobe). *Menhaden.* **Menhaden; Yellow-tail; Yellow-tailed shad; Fatback; Shad (N. C.); Bugfish (N. C.); Shiner (Fla.); Herring (Fla.).**

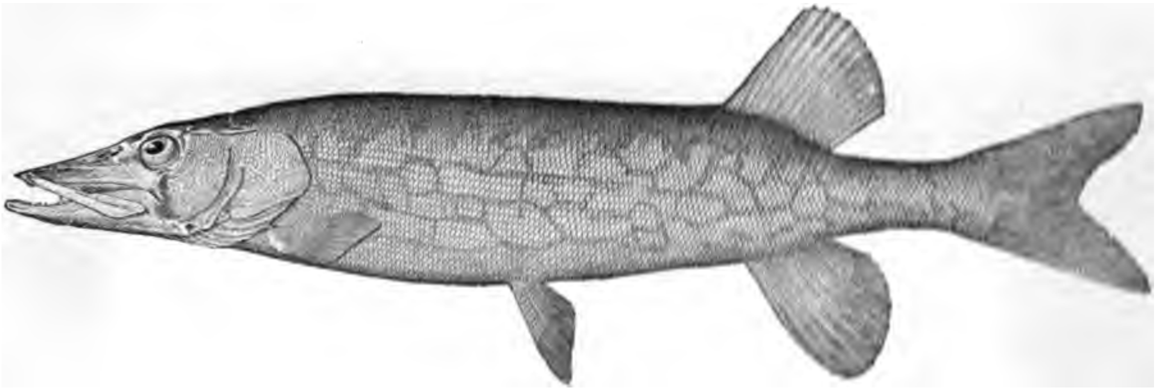


DOROSOMA CEPEDIANUM (Le Sueur). ***Gizzard shad; Mud shad.*** **Gizzard shad (N. C., S. C**
Nanny shad (N. C.); Hairy-back (N. C.); Thread herring (N. C.); Stink shad (

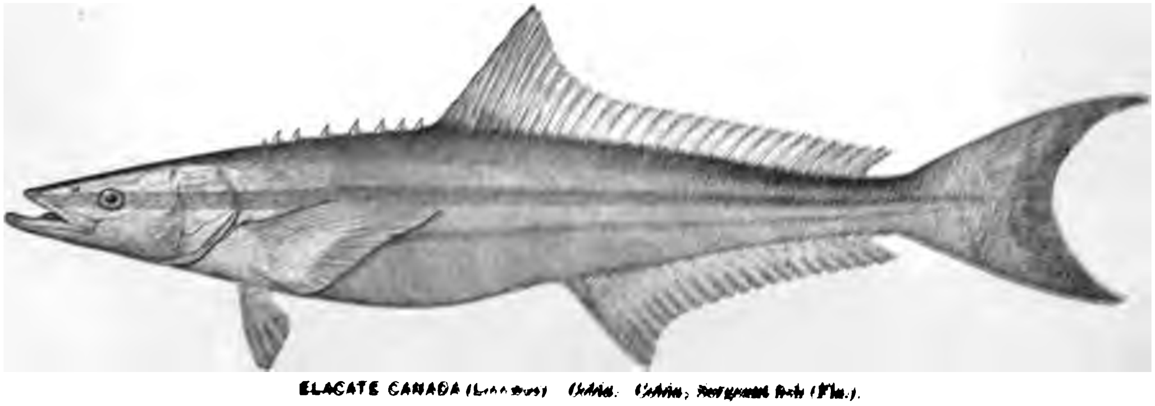
PLATE L.



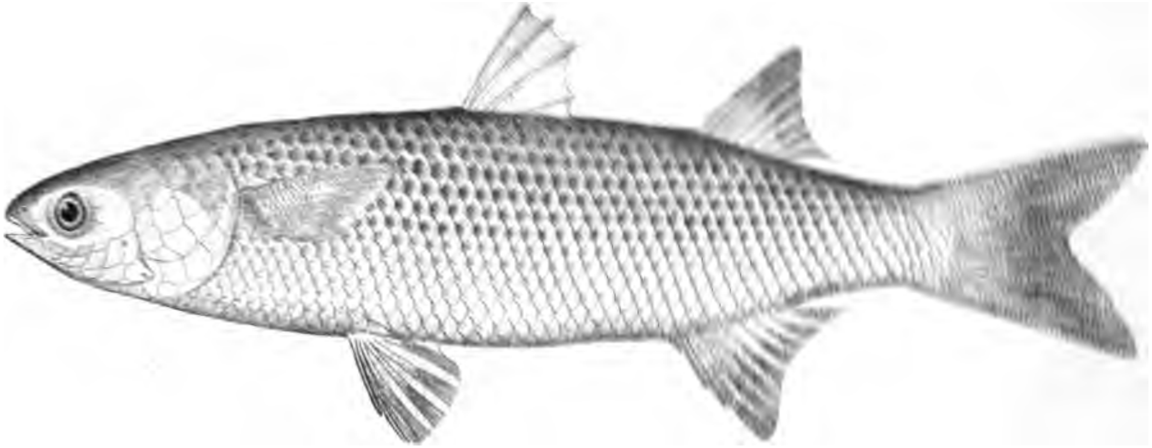
LUCIUS AMERICANUS (Gmelin). *Banded pickerel.* Pike (N. C.); Red-finned pike (N. C.); Jack (Ga.).



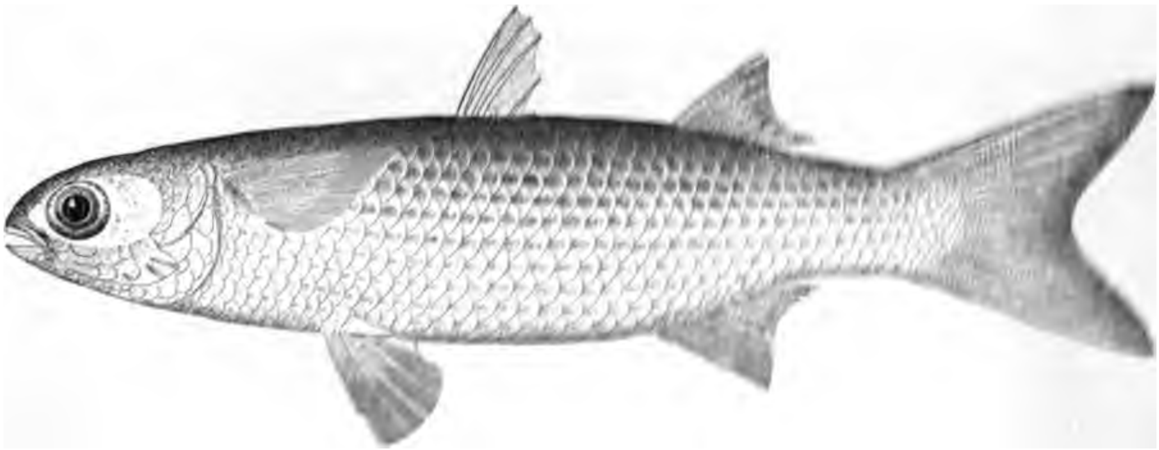
LUCIUS RETICULATUS (Le Sueur). *Eastern pickerel.* Pike (N. C.); Red-finned pike (N. C.); Duck-billed pike (N. C.); Jack (N. C., S. C.); Pickerel (S. C.).



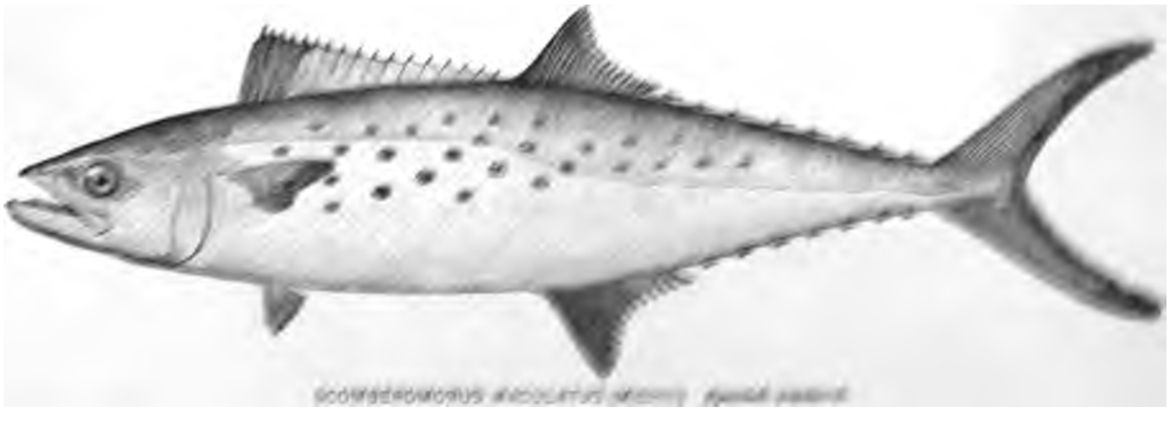
ELACATE CANADA (Linnæus). *Cobia.* Cobia; Sergeant fish (Fla.).



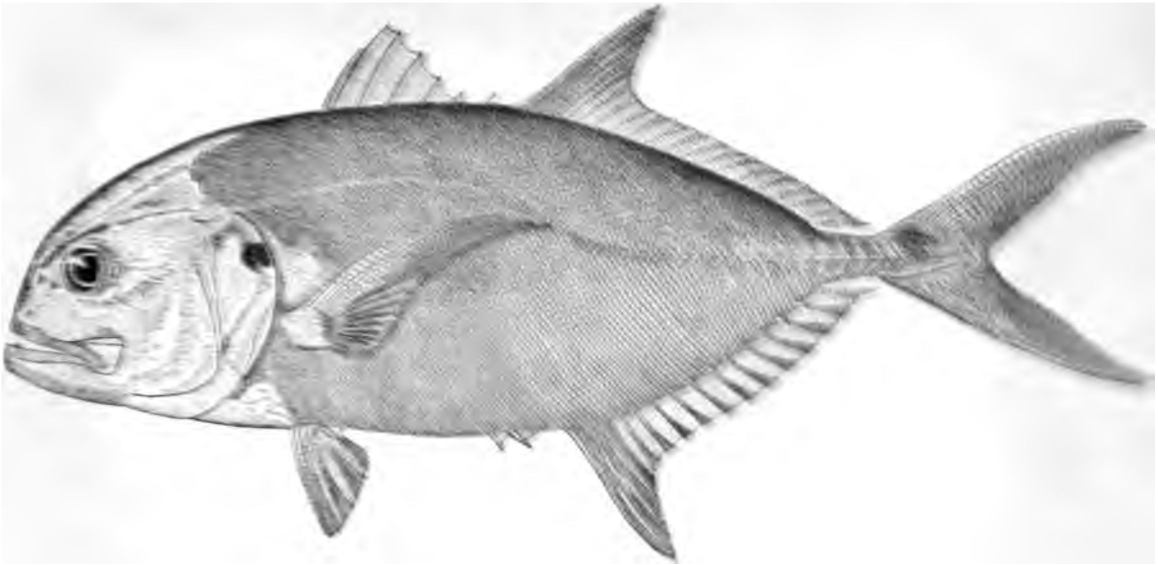
MUGIL CEPHALUS Linnæus. *Common mullet; Striped mullet.* Mullet; Jumping mullet (N. C.); Sand mullet (N. C.); Striped mullet (N. C., Fla.); Silver mullet (Fla.); Big-eyed mullet (Fla.)



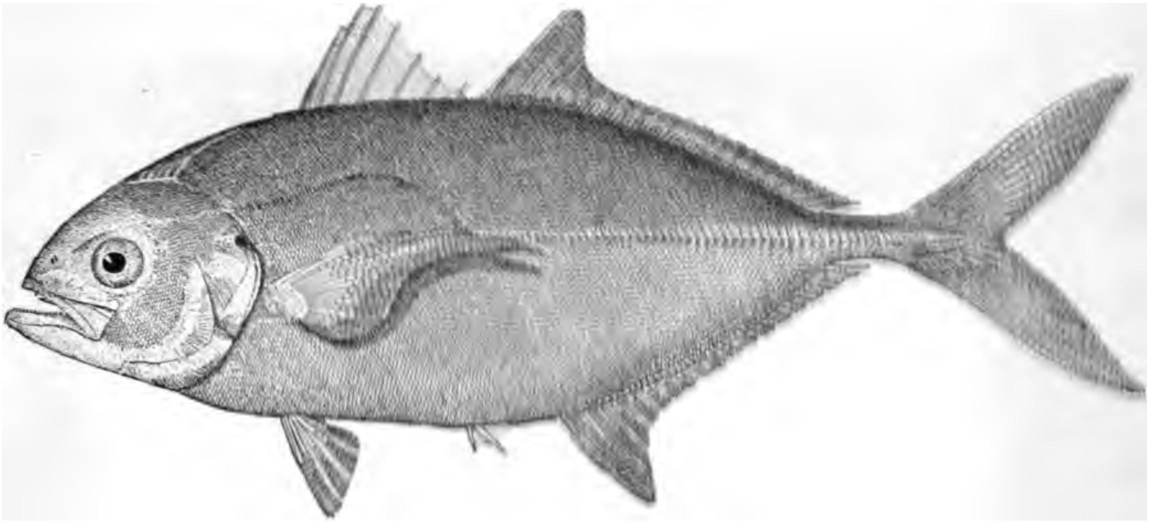
MUGIL CUREMA Cuvier and Valenciennes. *White mullet.* Mullet; White mullet (N. C., Fla.)



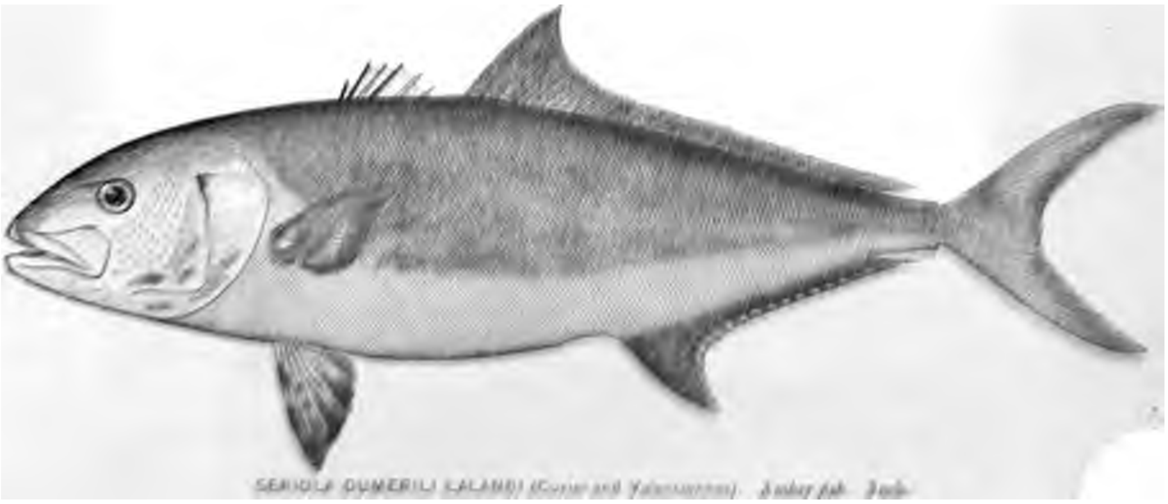
SCOMBEROMORUS MACULATUS (Mitchill). *Spanish mackerel.*



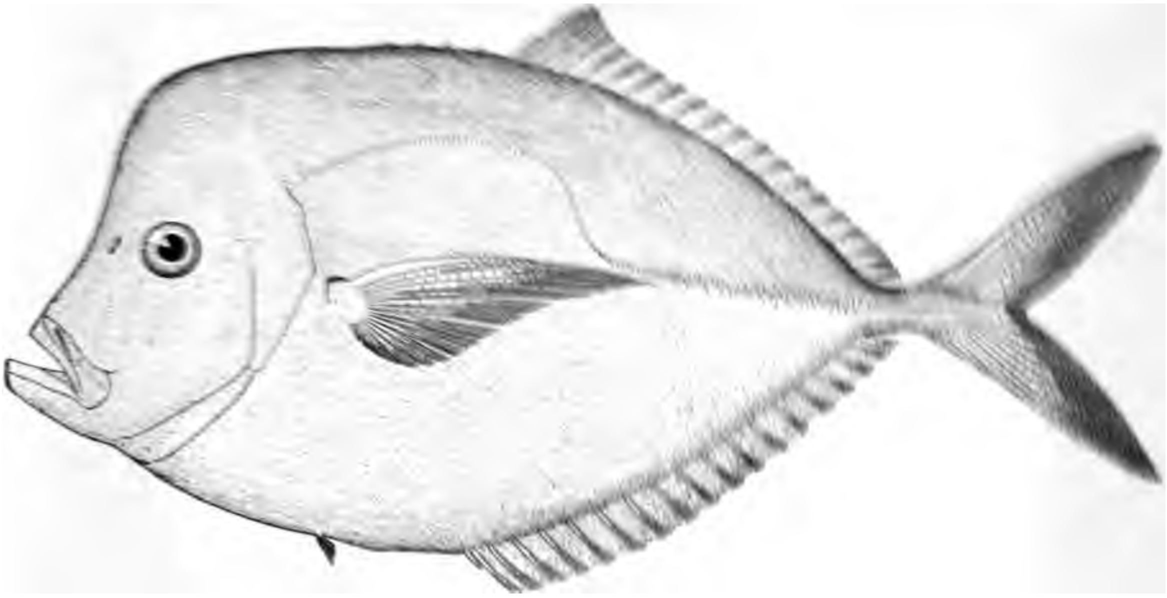
CARANX HIPPOS (Linnæus). *Cavally.* Cavally. Crevalle. Jack. Horse crevalle (S. C.). Jack crevalle (S. C.)



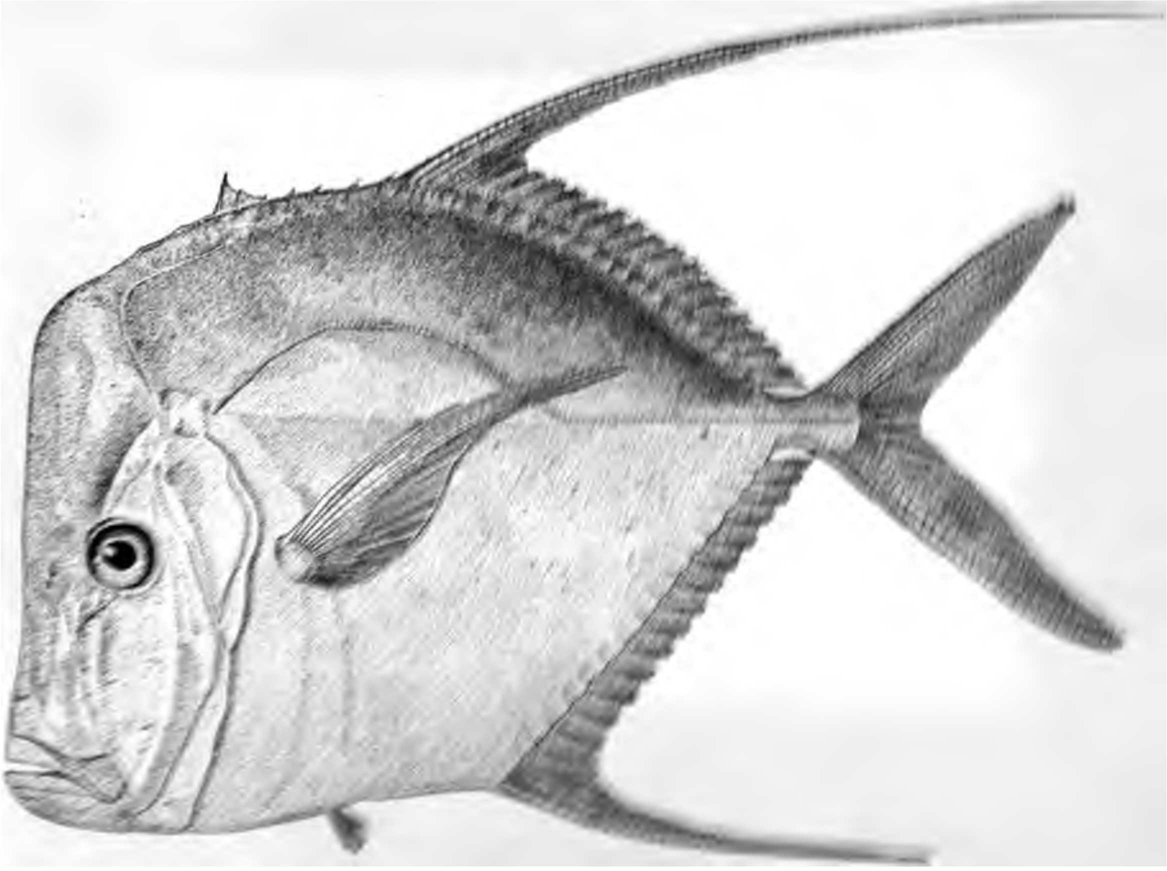
CARANX CHRYSOS (Mitchill). *Jurel.* Horse mackerel (N. C.), Sunfish (N. C.), Horse crevalle (S. C.), Jack crevalle (S. C.)



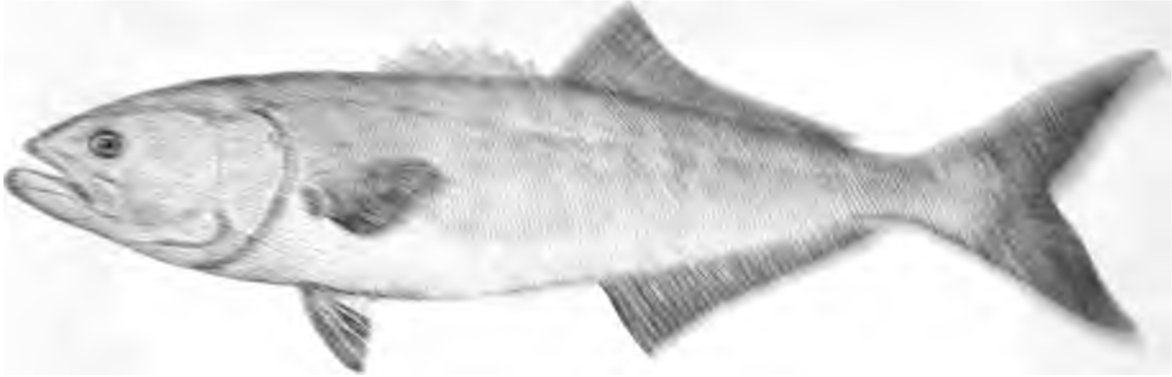
SERIOLA DUMERILI LALANDI (Cuvier and Valenciennes). *Amber fish. Jack.*



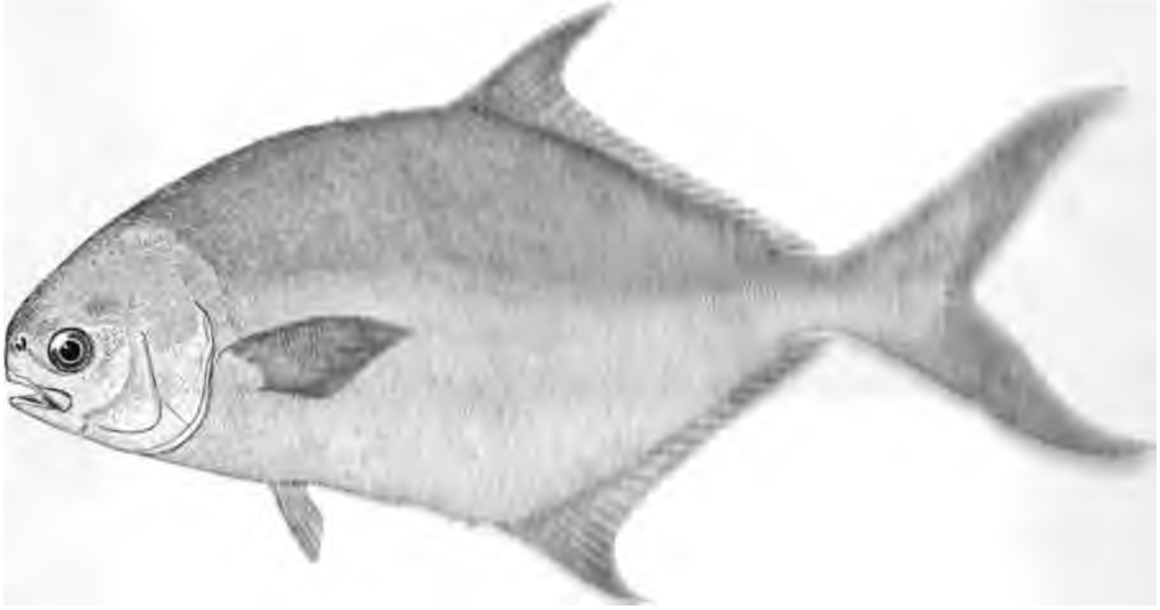
VOMER SETIPINNIS (Mitchill). *Blunt-nosed shiner. Moonfish.* Moonfish (N. C., Fla.). Sunfish (N. C.).



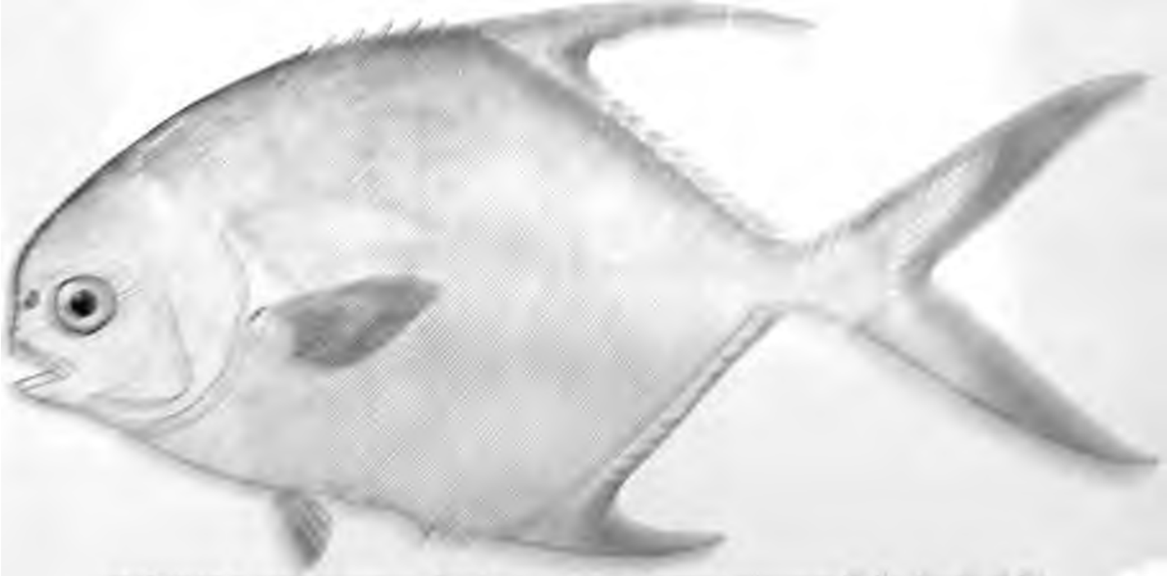
SELENE VOMER (Linnæus). Silver moonfish. Moonfish (N. C.). Horsefish (N. C.). (Not usually distinguished by the fishermen from Vomer setipinnis.)



POMATOMUS SALTATRIX (Linnæus). Bluefish. [illegible]

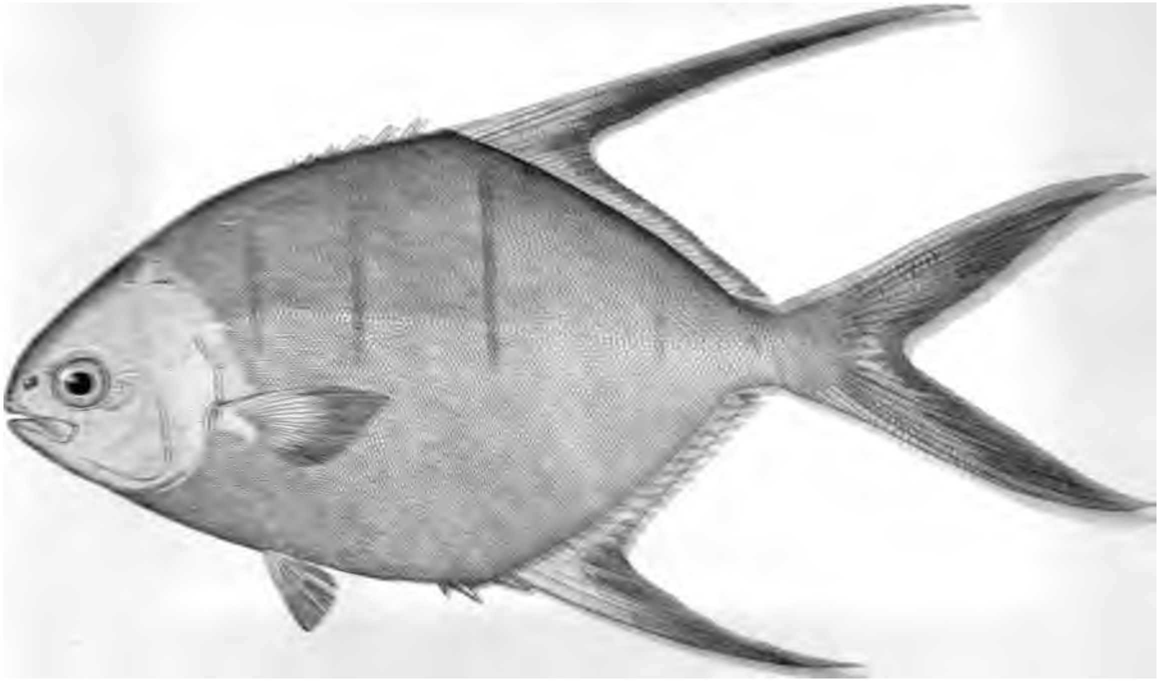


TRACHYNOTUS CAROLINUS (Linnæus). Common pompano. Pompano. [illegible]

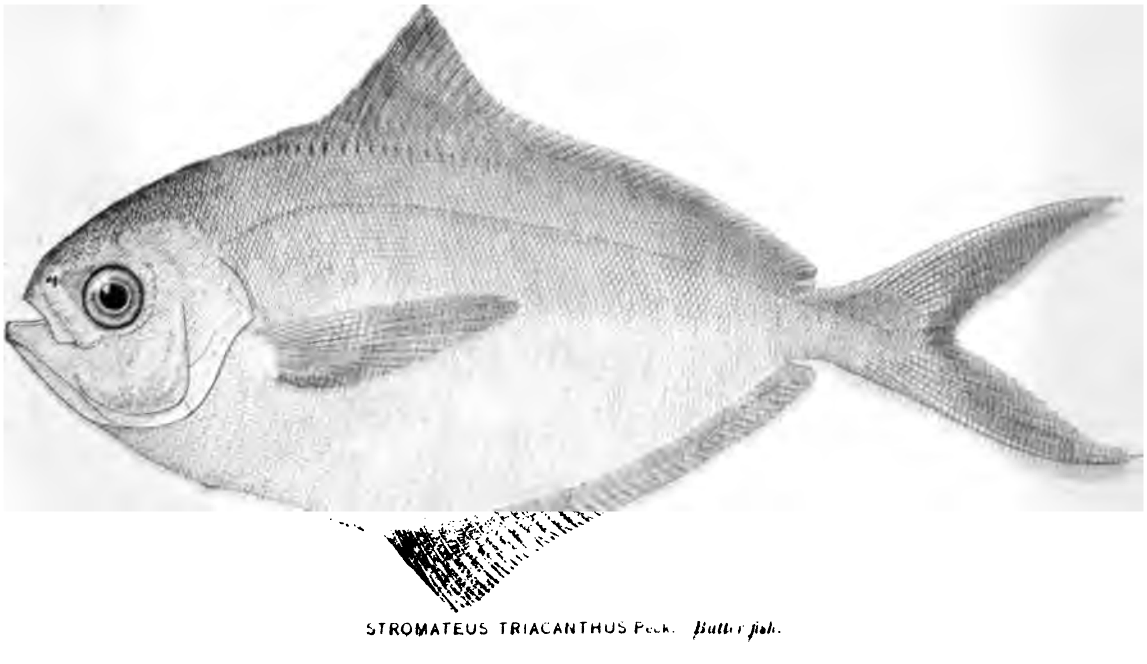


TRACHYNOTUS [illegible]. Banded pompano. [illegible]

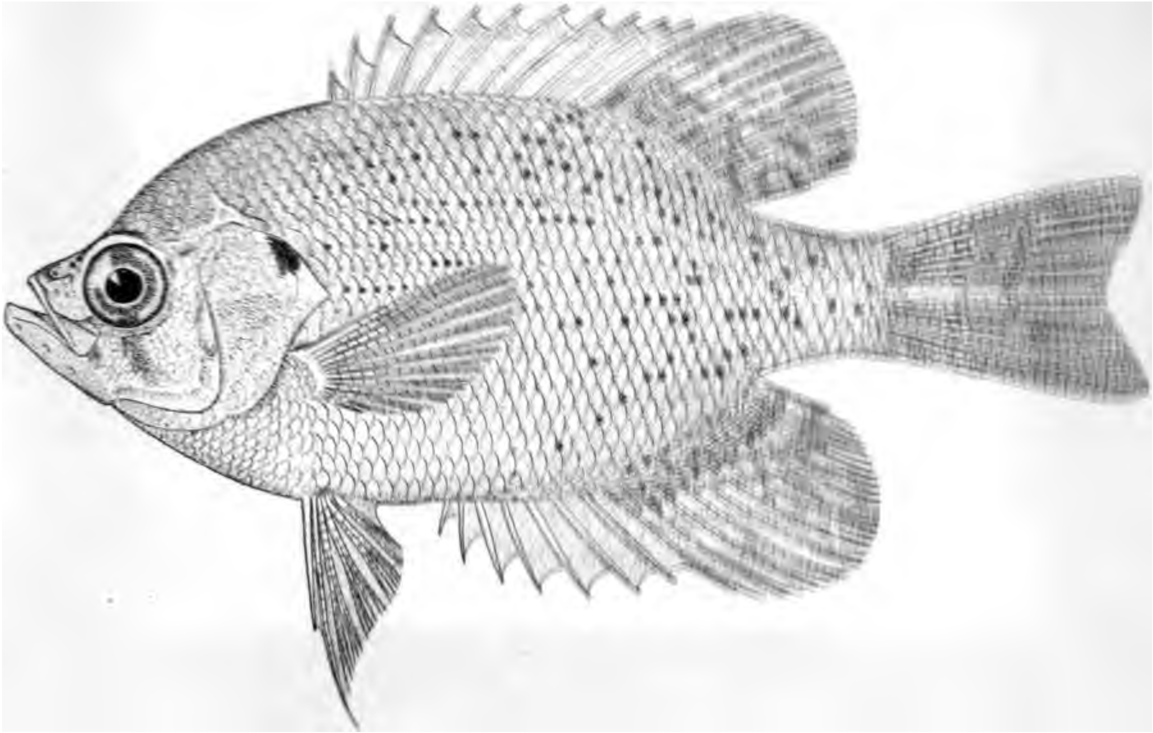
PLATE LV.



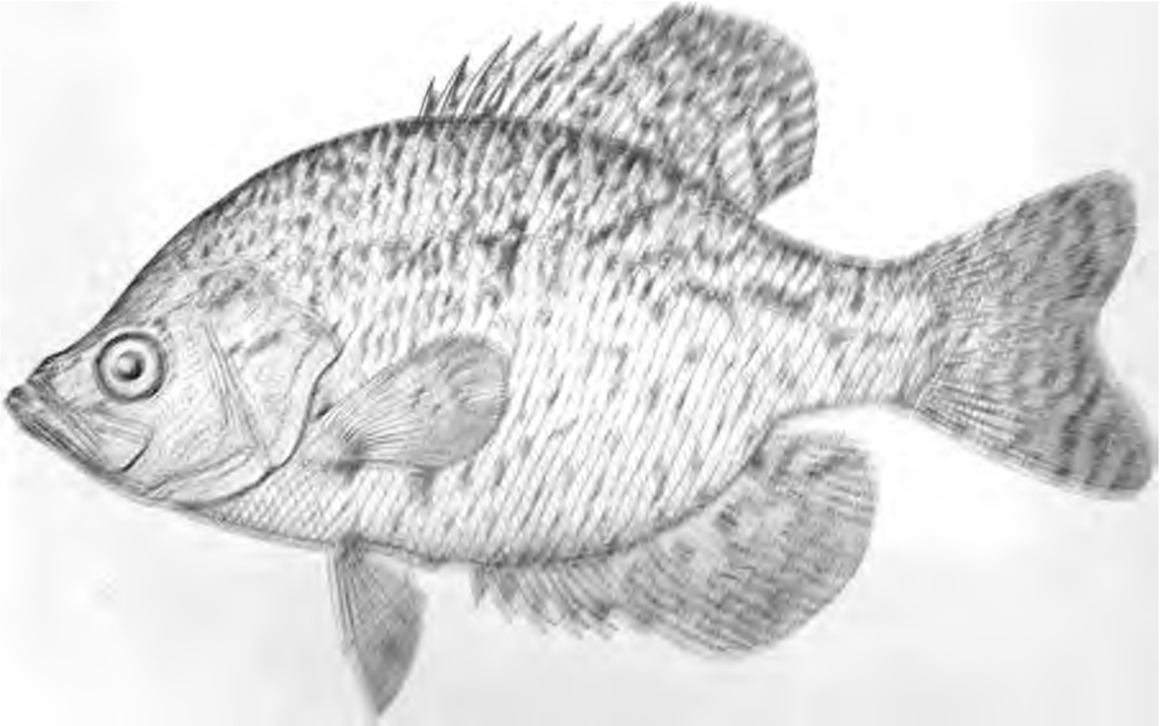
TRACHYNOTUS GLAUCUS Cuvier and Valenciennes. *Runner pompano.*



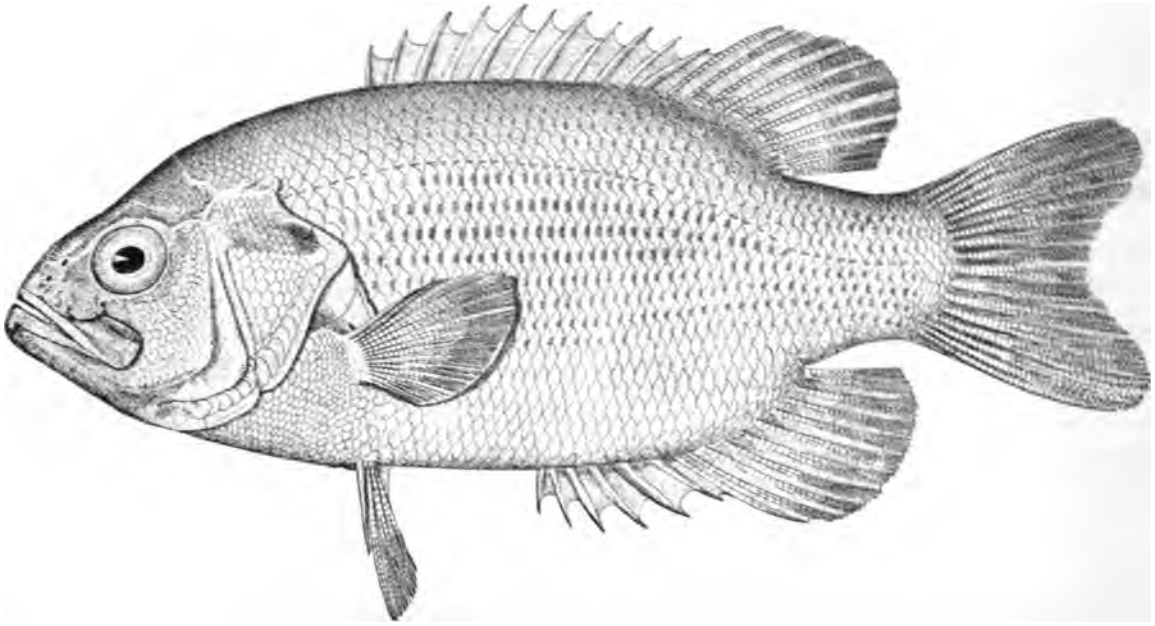
STROMATEUS TRIACANTHUS Peck. *Butter-fish.*



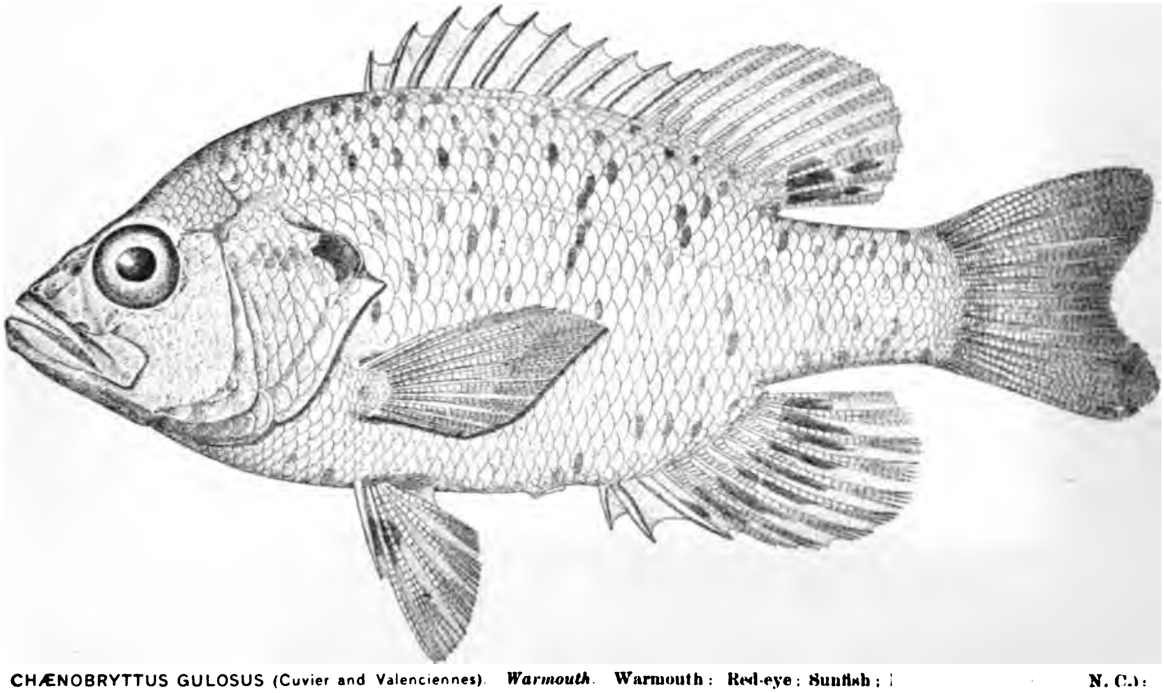
CENTRARCHUS MACROPTERUS (Lacépède). Sunfish. Sunfish; Flier (N. C.). Mill pond perch (N. C.).



POMOXIS SPAROIDES (Lacépède). Strawberry bass. Calico bass. Speckled perch (S. C. Fla.). Calico bream (S. C.). Spotted trout (Ga.).

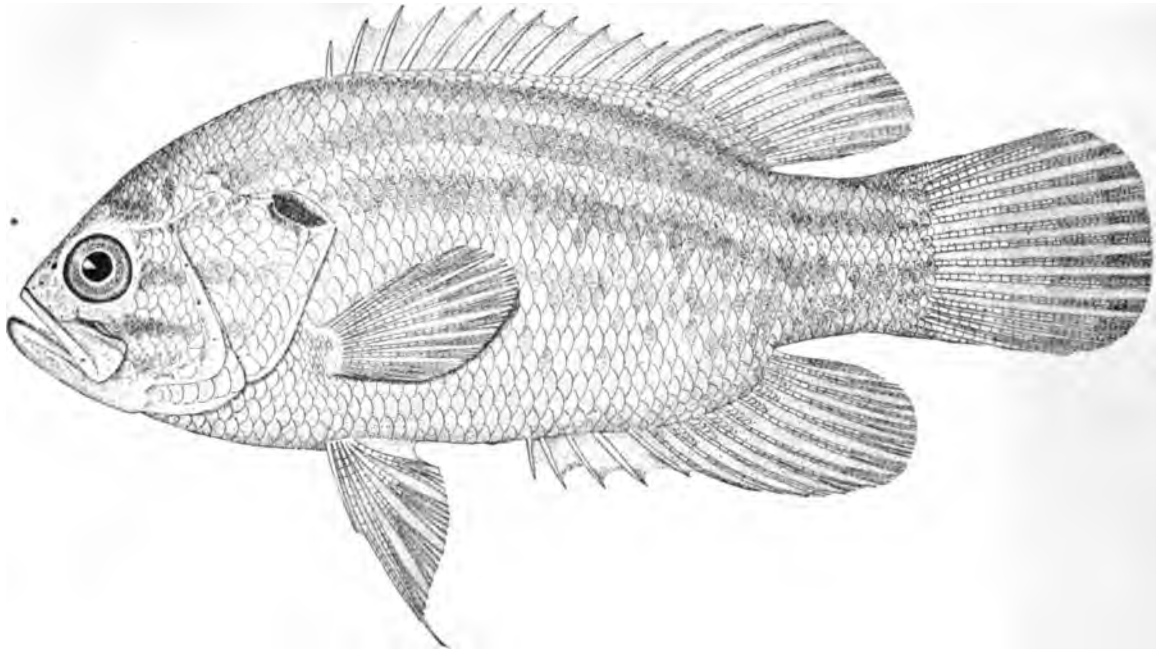


AMBLOPLITES RUPESTRIS (Rafinesque). ***Rock bass.*** **Red-eye ; Bream ; Red-eyed bream.**

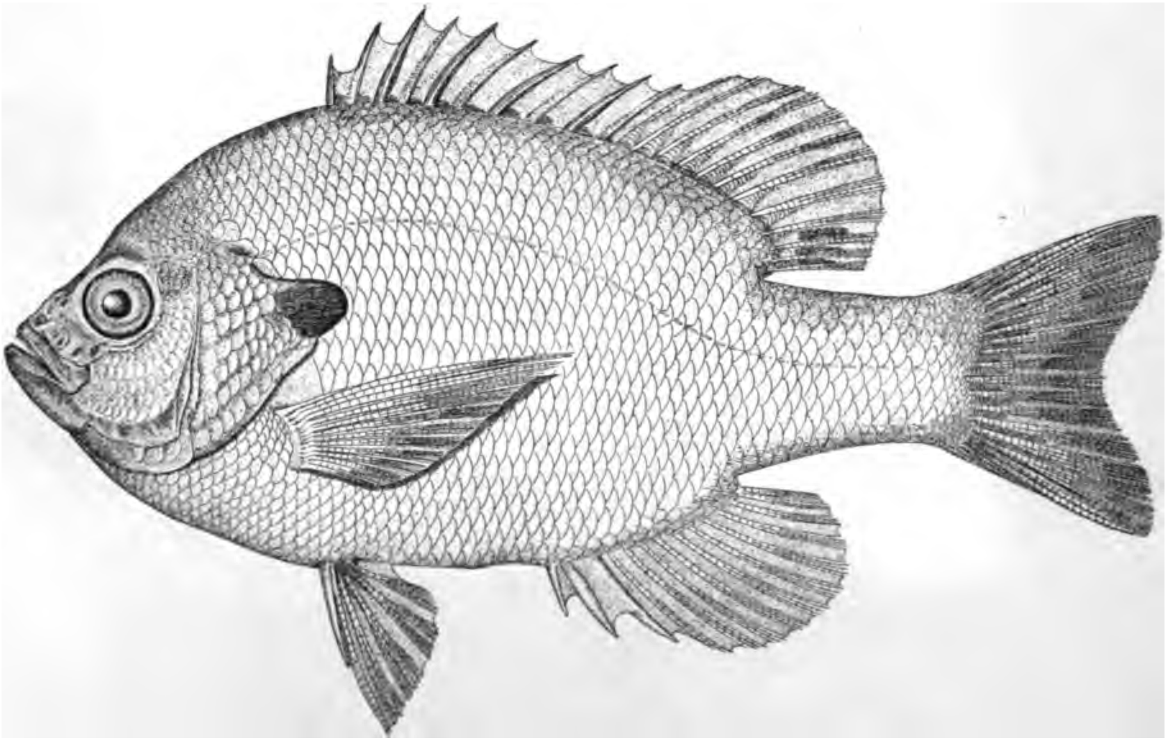


CHÆNOBRYTTUS GULOSUS (Cuvier and Valenciennes). ***Warmouth.*** **Warmouth : Red-eye ; Sunfish ;** **N. C.): Goggle-eye (N. C.); Mud chub (N. C.); Warmouth perch (S. C., Ga., Fla.); More-mouth bream (S. C.); perch (Ga.); Warm-mouth perch (Ga.).**

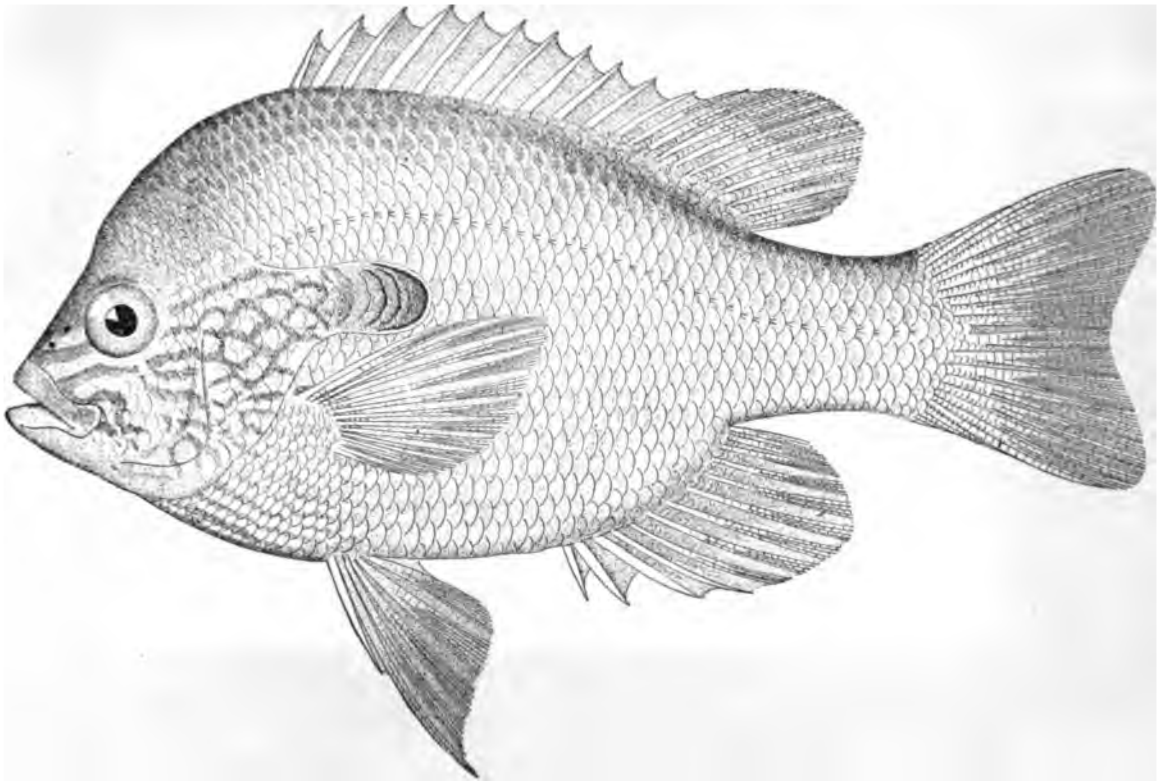
PLATE LVIII.



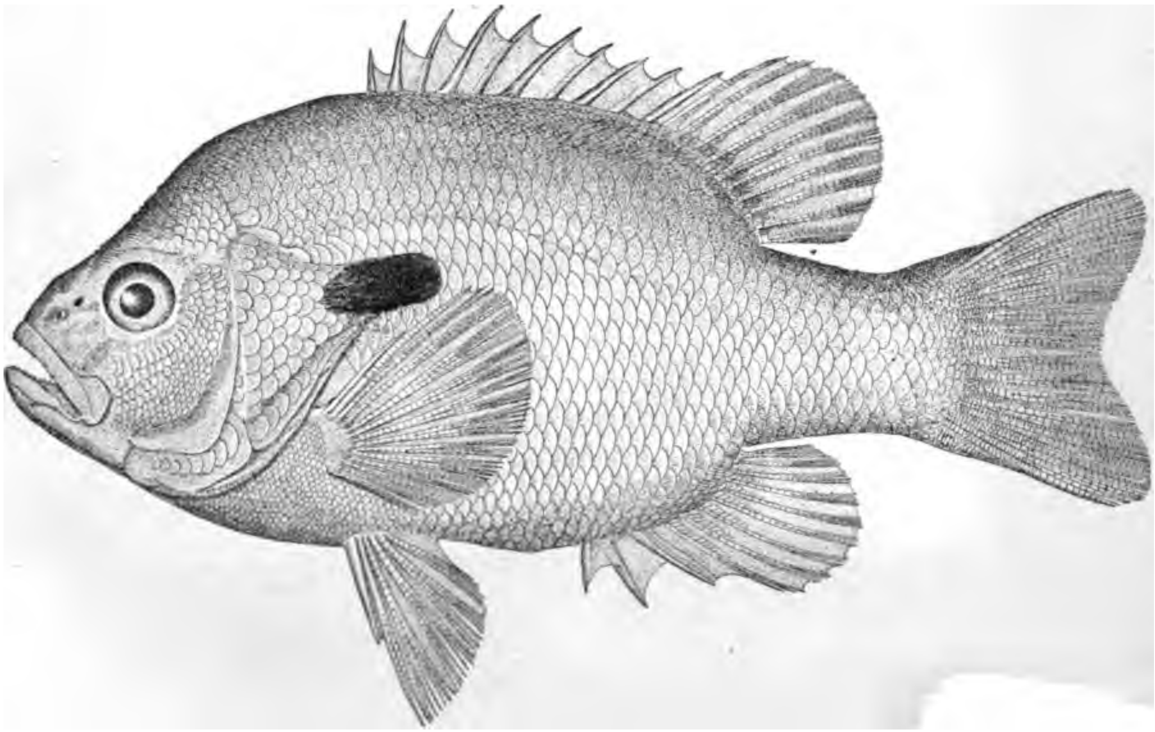
ACANTHARCHUS POMOTIS (Baird). ***Mud bass; Mud sunfish.*** **Mud perch (N. C.).**



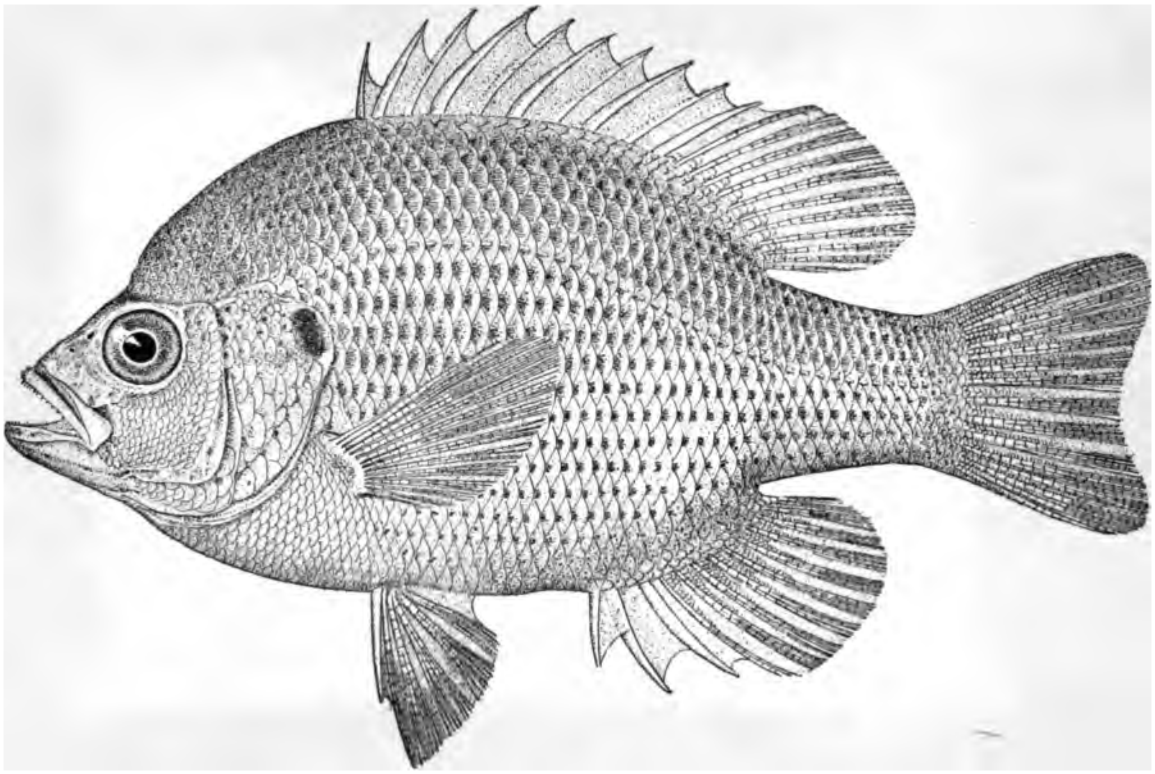
LEPOMIS PALLIDUS (Mitchill). ***Blue sunfish.*** **Blue sunfish: Copper-nosed bream: Blue perch (N. C); Blue joe (N. C.); Blue bream (S. C.); Copperhead bream (Fla.).**



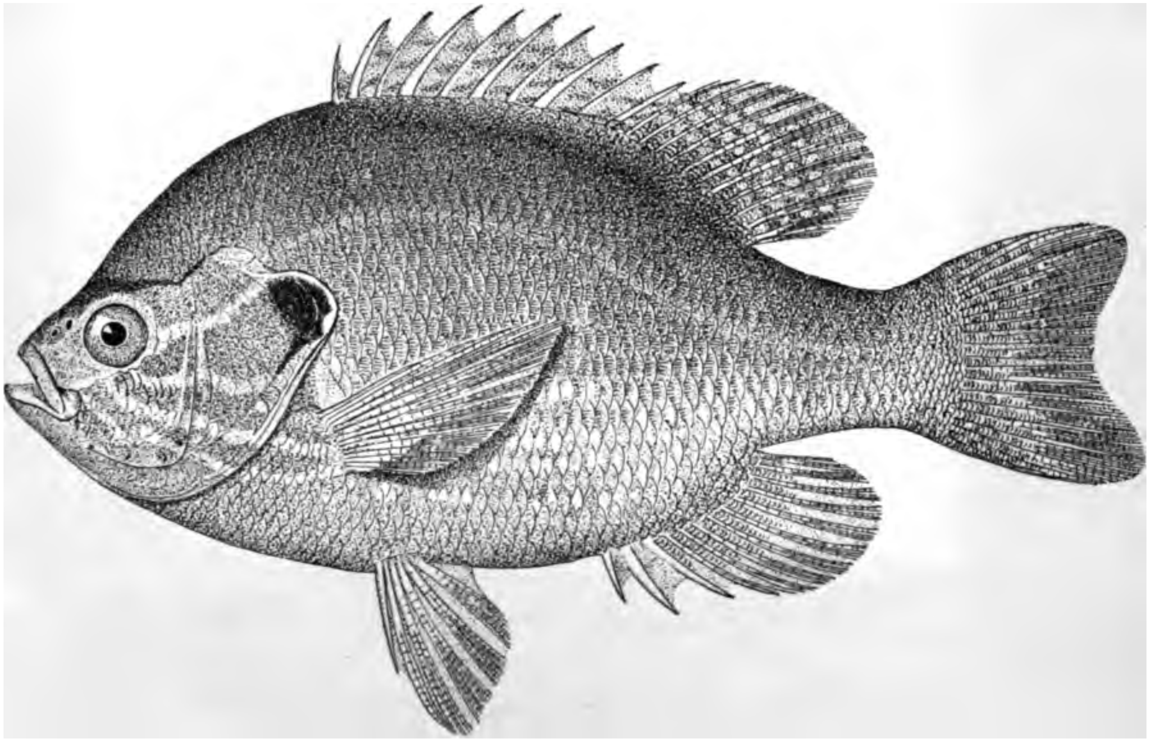
LEPOMIS MEGALOTIS (Rafinesque). *Large-eared sunfish.* **Red-bellied perch (Ga.).**



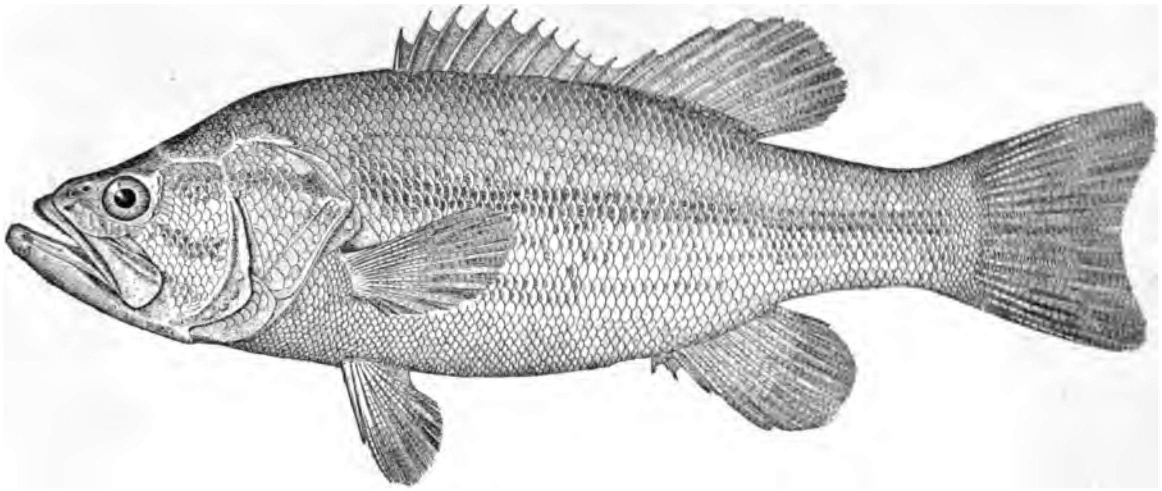
LEPOMIS AURITUS (Linnæus). ***Long-eared sunfish.*** **Sunfish; Bream; Red-bellied perch; Red-l**
Robin perch (N. C.); Red-belly (N. C.); Yellow-belly (N. C.); Leather-ear C.);



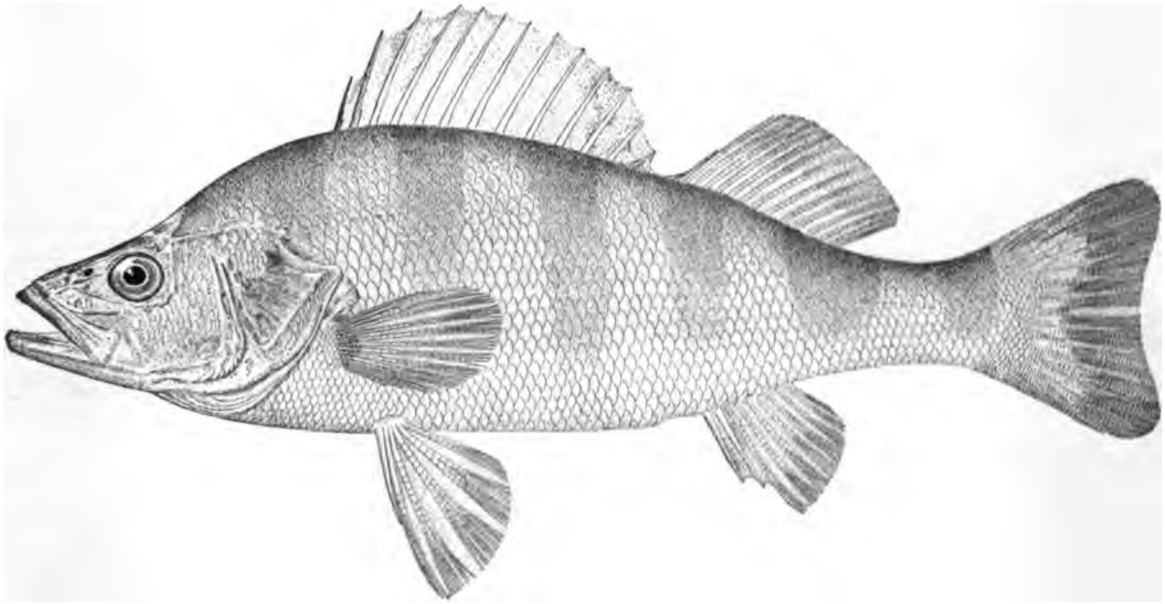
LEPOMIS PUNCTATUS (Cuvier and Valenciennes). Chinquapin perch (Fla.).



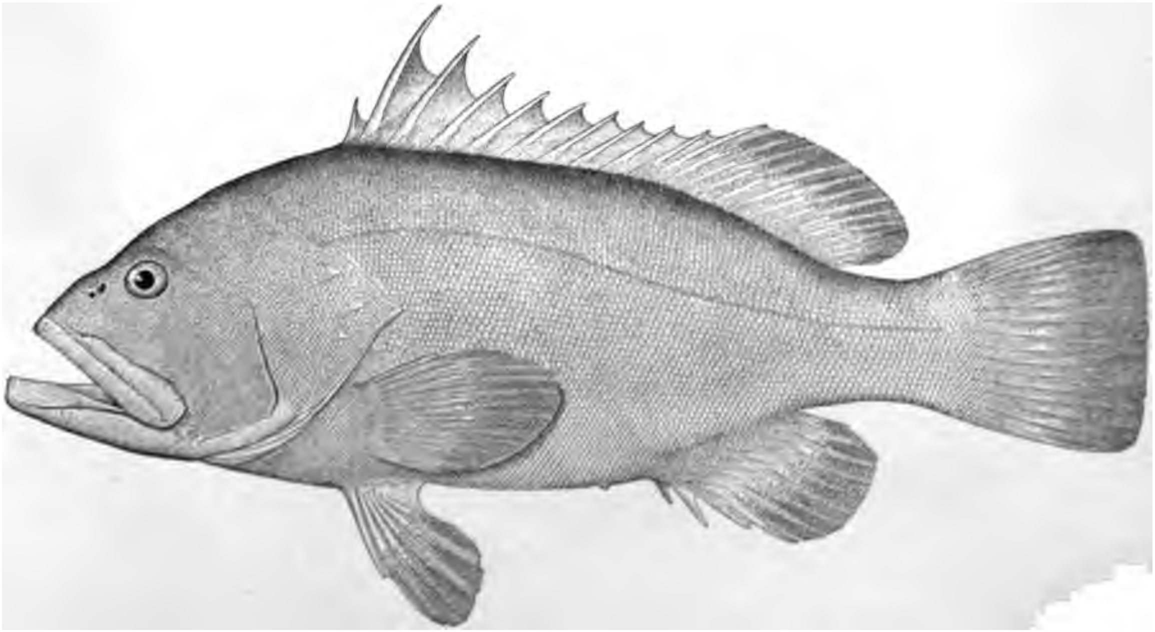
LEPOMIS GIBBOSUS (Linnæus). ***Common sunfish.*** **Bream; Perch; Robin (N. C.); Robin perch (N. C.); Red-belly (N. C.); Yellow-belly (N. C.); Sand perch (N. C.).**



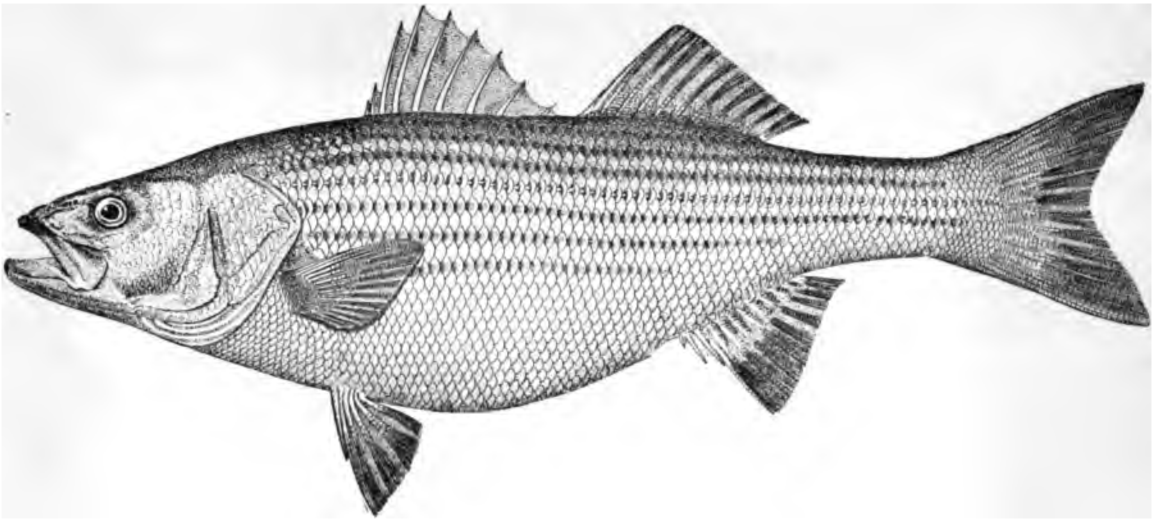
MICROPTERUS SALMOIDES (Lacépède). *Large-mouthed black bass.* **Trout; Fresh-water trout (S. C., Ga., Fla.); Chub (N. C.); Welchman (N. C.).**



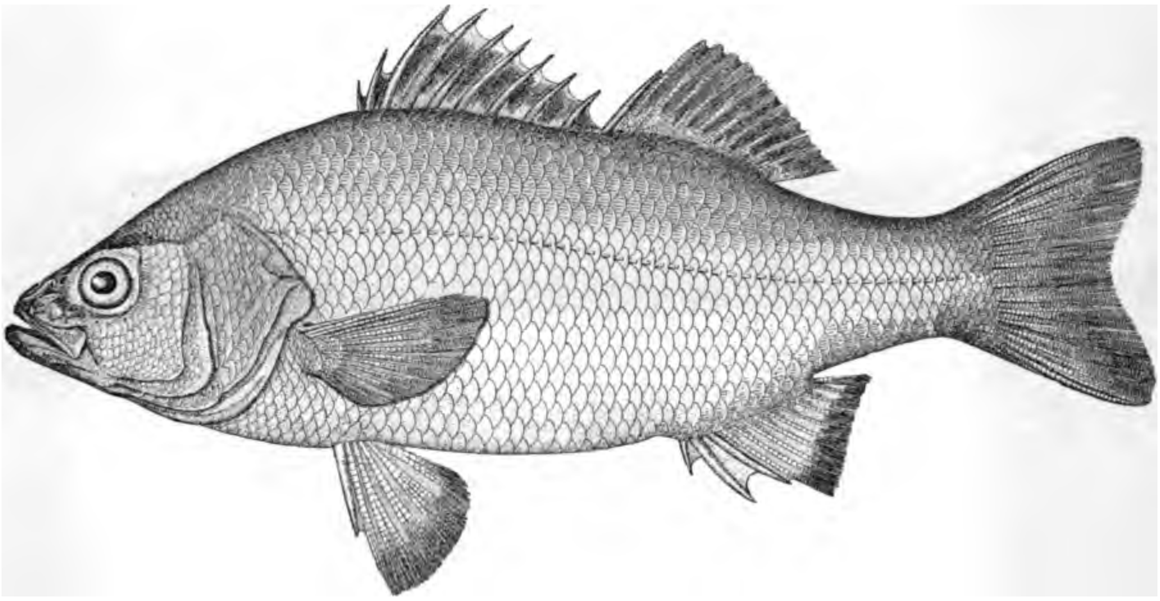
PERCA FLAVESCENS (Mitchill). *Yellow perch.* **Englishman (N. C.); Raccoon perch (N. C.); Redfin (N. C.).**



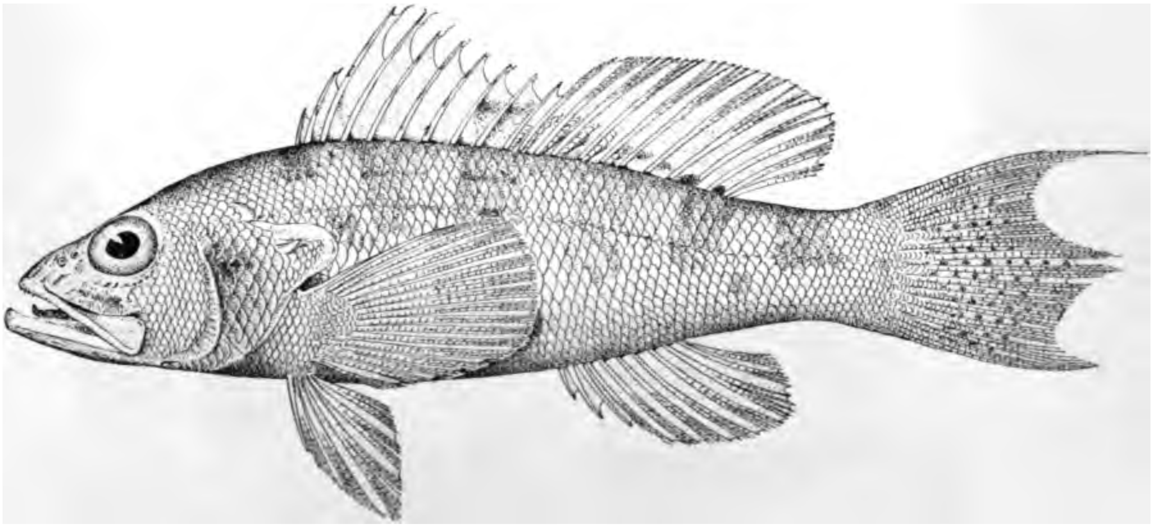
EPINEPHELUS NIGRITUS (Holbrook) *Black grouper.* **Jewfish.**



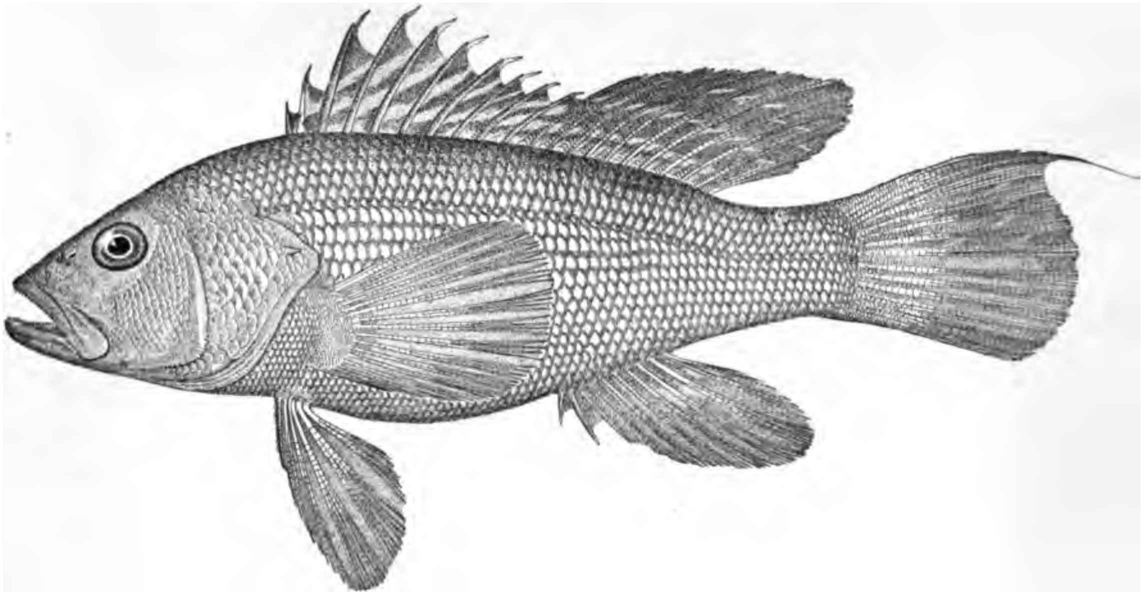
ROCCUS LINEATUS (Bloch). *Striped bass; Rockfish.* Rock; Rockfish.



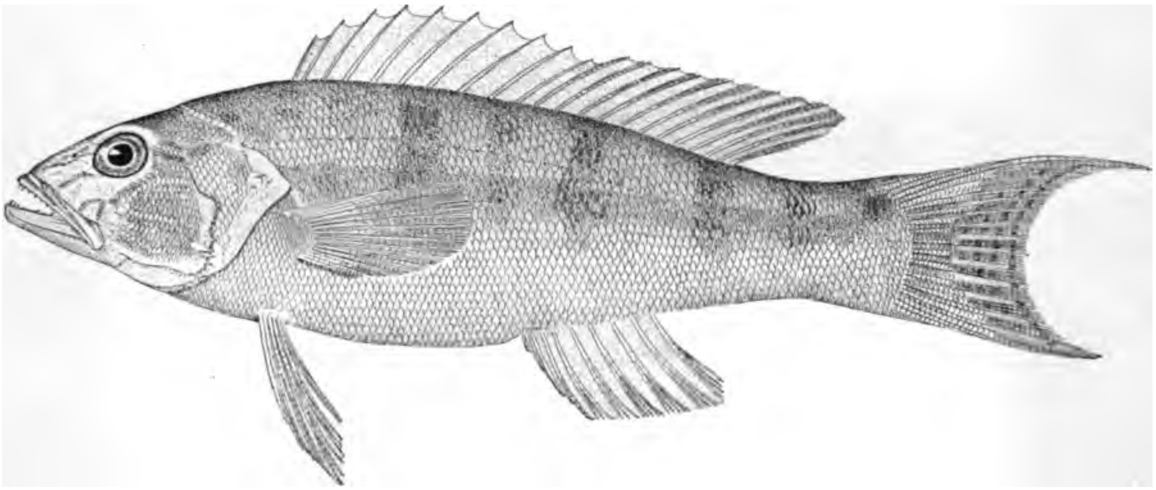
MORONE AMERICANA (Gmelin). *White perch.* Perch (N. C.); White perch (N. C.); Silver perch (N. C.).



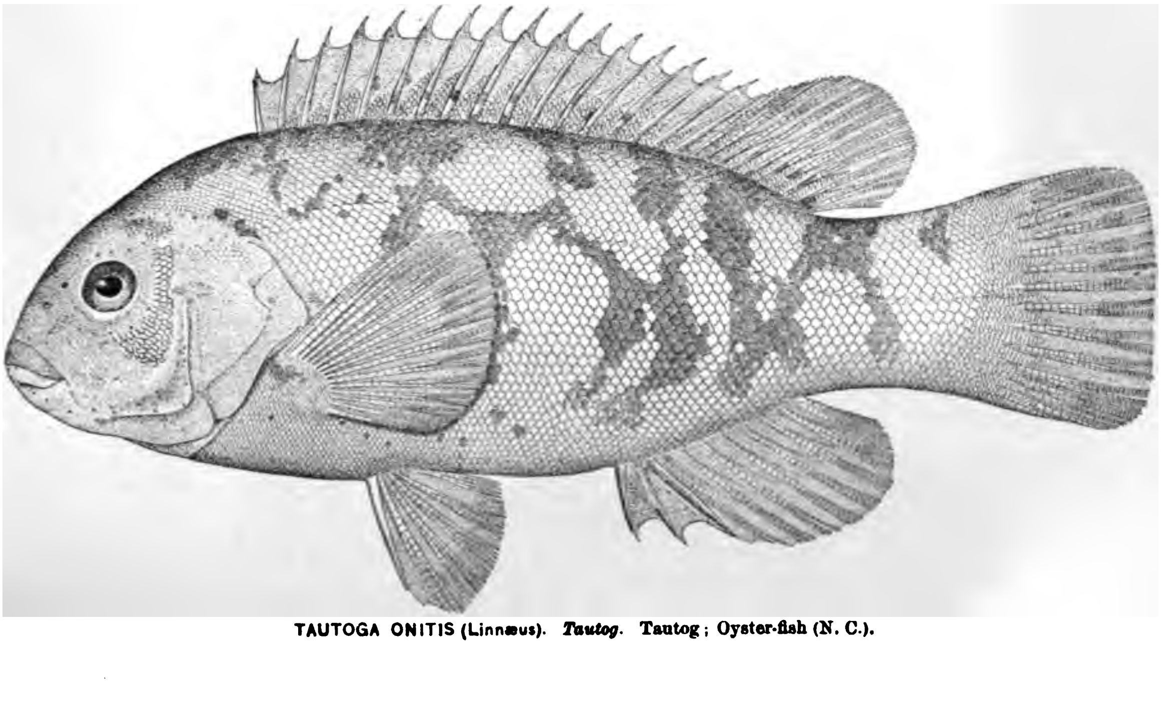
CENTROPRISTIS PHILADELPHICUS (Linnæus). Rock blackfish (S. C.); Rockfish (S. C.).



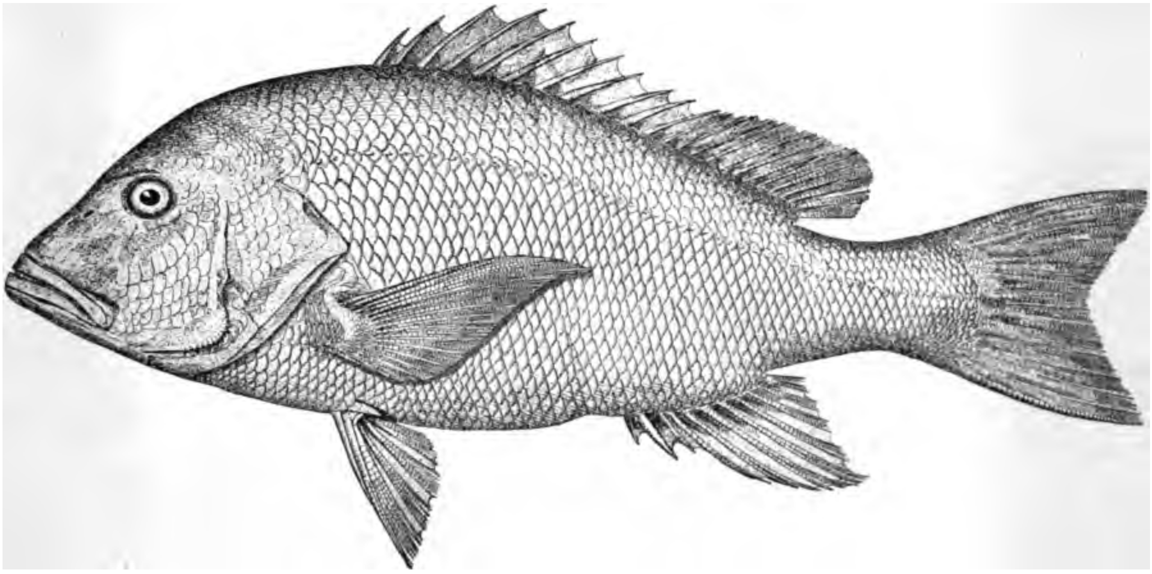
CENTROPRISTIS STRIATUS (Linnæus). *Sea bass; Blackfish.* Blackfish.



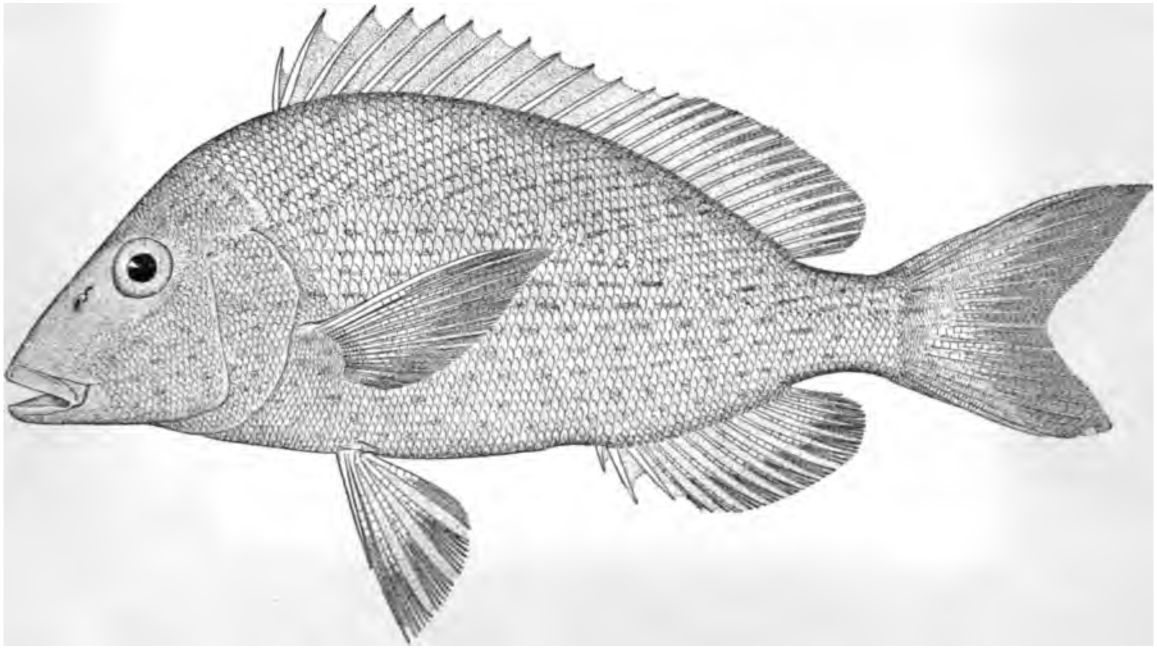
DIPLECTRUM FORMOSUM (Linnæus). *Squirrel-fish.*



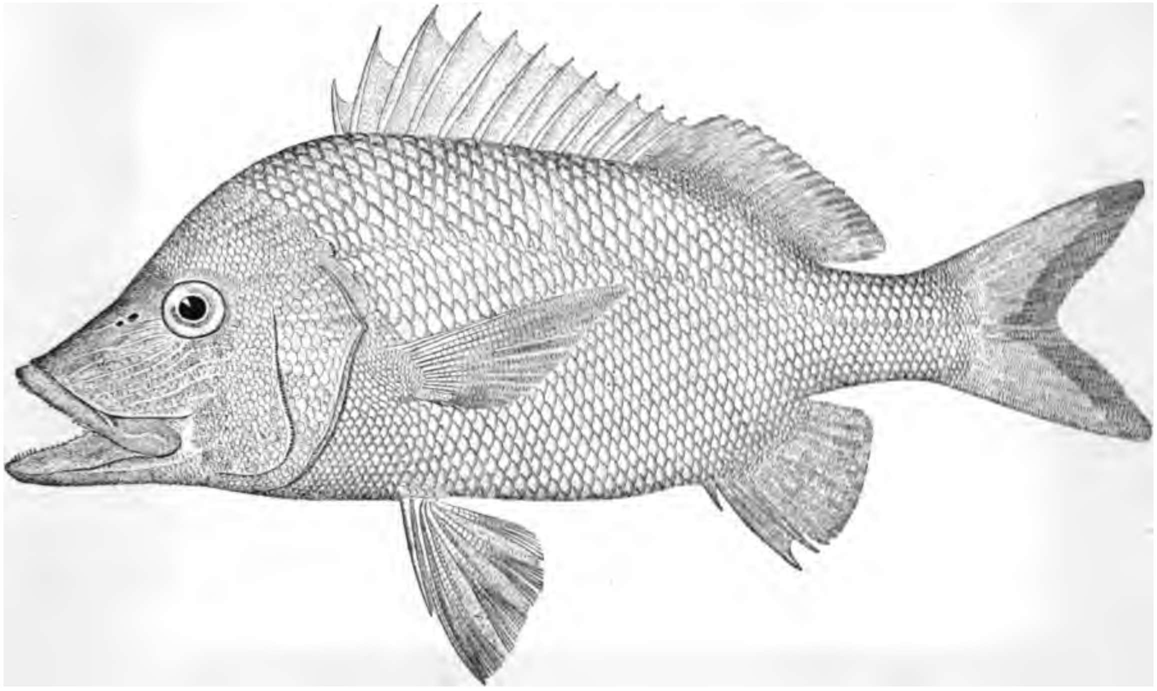
TAUTOGA ONITIS (Linnæus). ***Tautog.*** **Tautog; Oyster-fish (N. C.).**



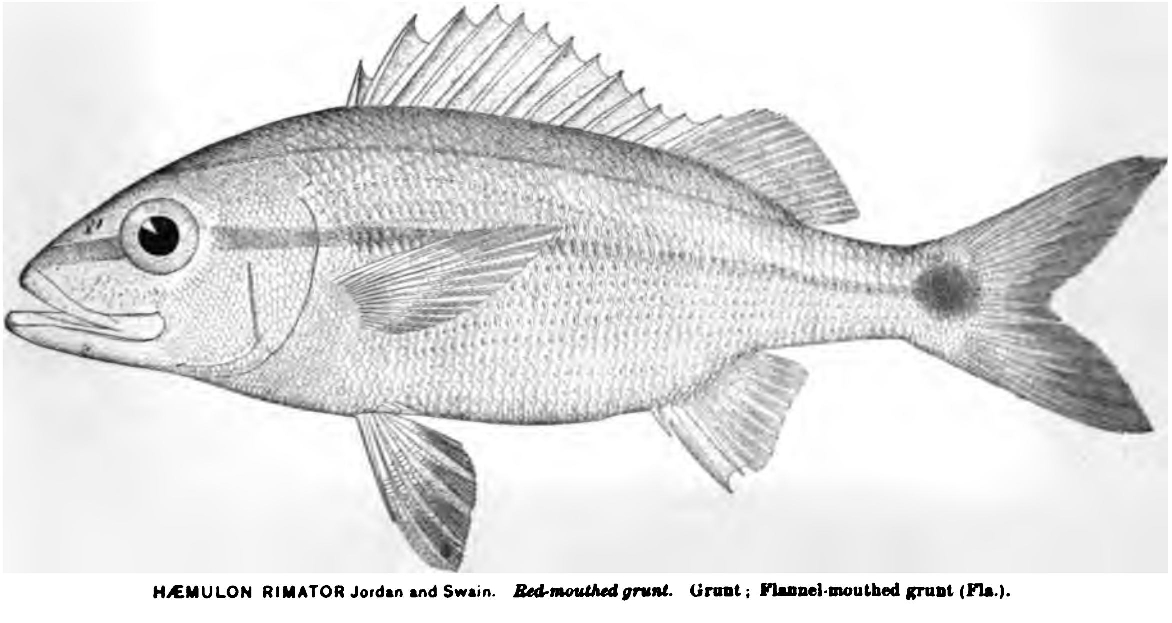
LUTJANUS AYA (Bloch). *Red snapper*.



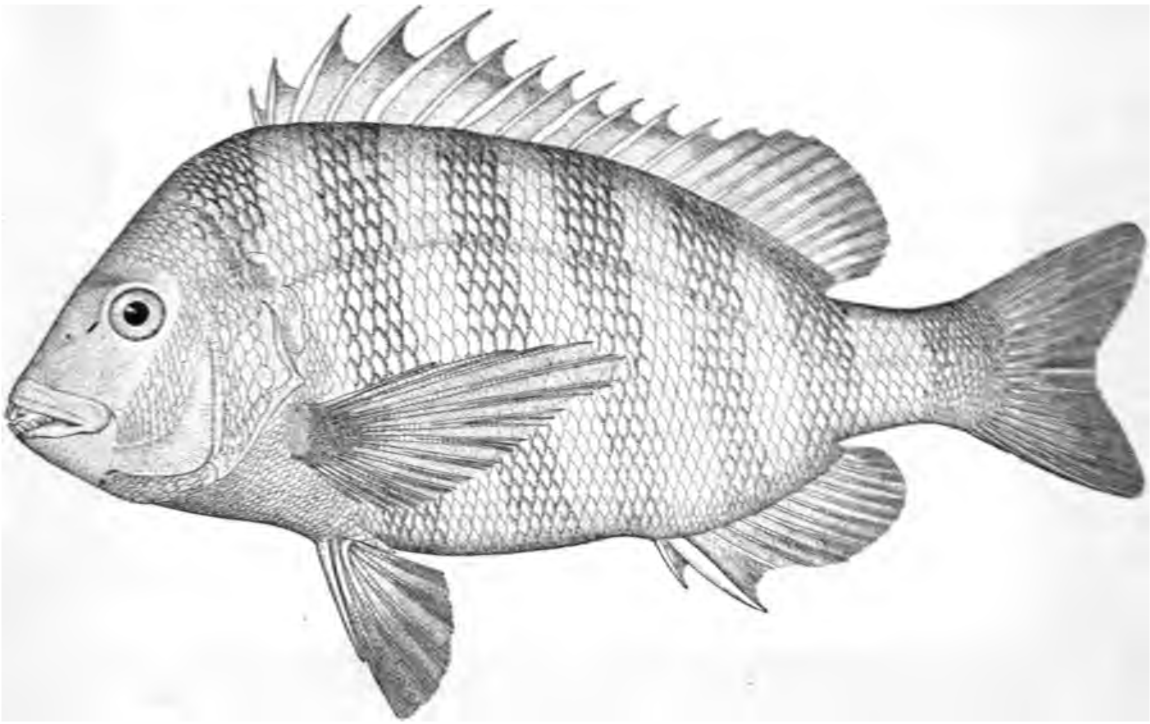
ORTHOPRISTIS CHRYSOPTERUS (Mitchill). ***Hogfish.*** **Grunt; Pigfish (N. C.); Hogfish (N. C.); Sailor's choice (S. C., Fla.).**



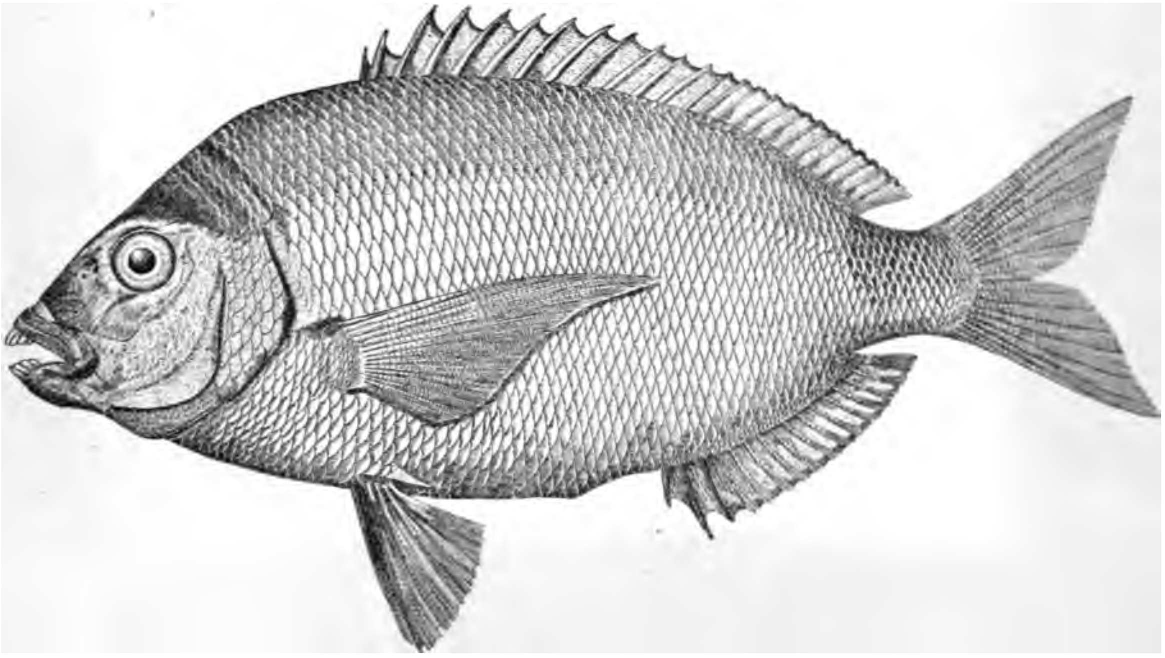
HÆMULON PLUMIERI (Lacépède). *Common grunt; Black grunt.* Grunt; Black grunt (S. C.).



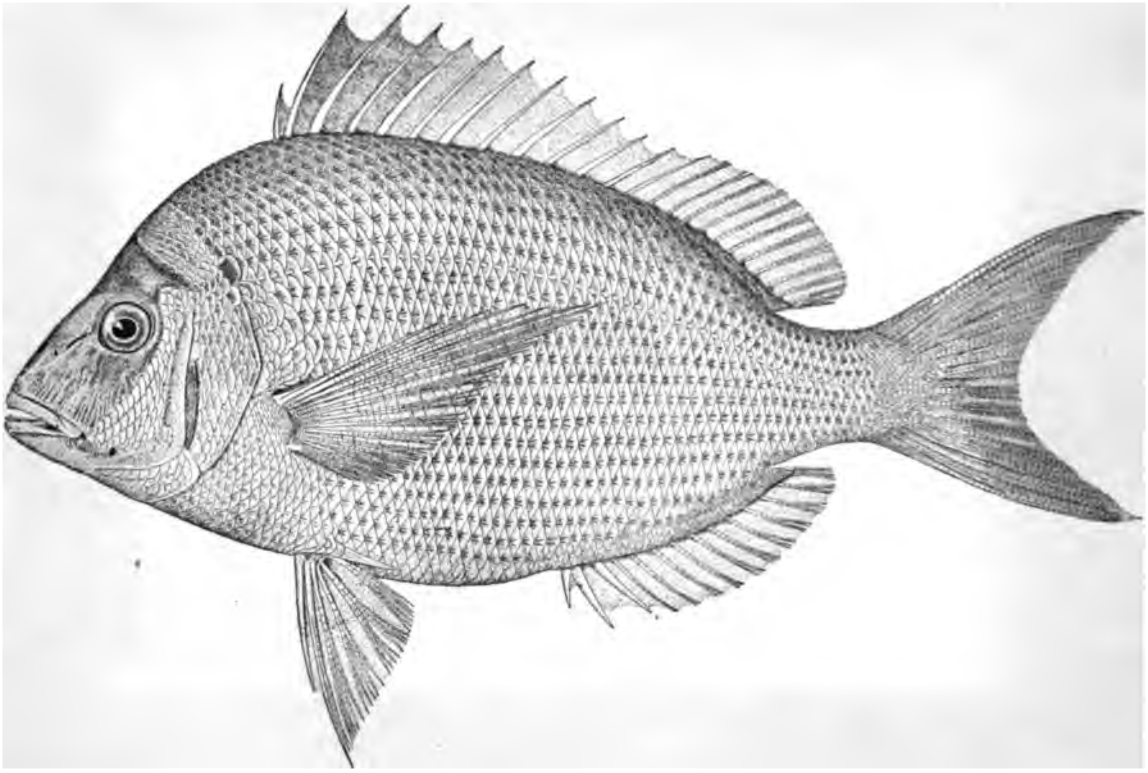
HÆMULON RIMATOR Jordan and Swain. ***Red-mouthed grunt.*** Grunt; **Flannel-mouthed grunt (Fla.).**



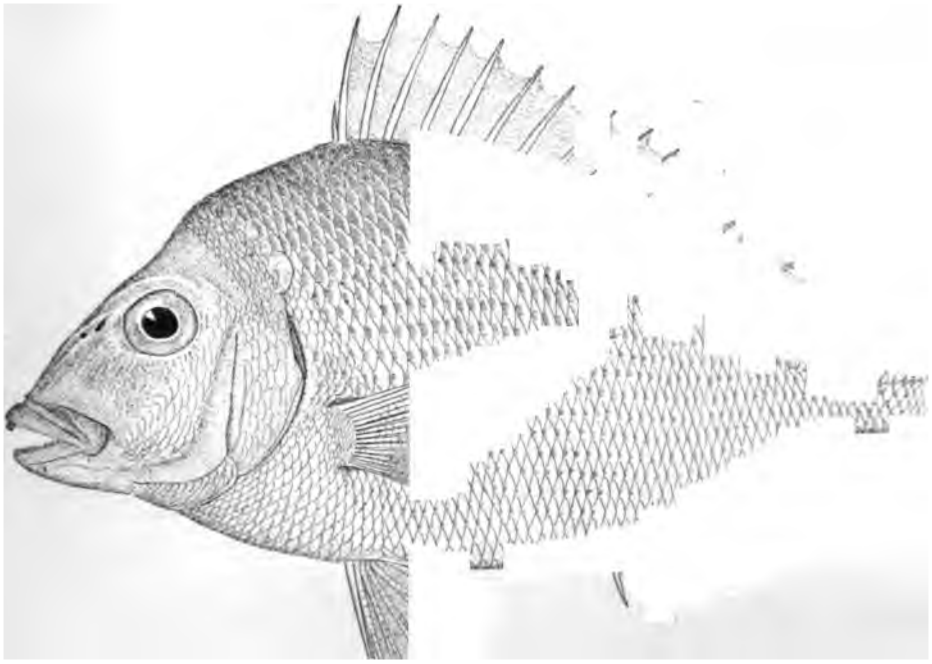
ARCHOSARGUS PROBATOCEPHALUS (Walbaum). *Sheepshead.*



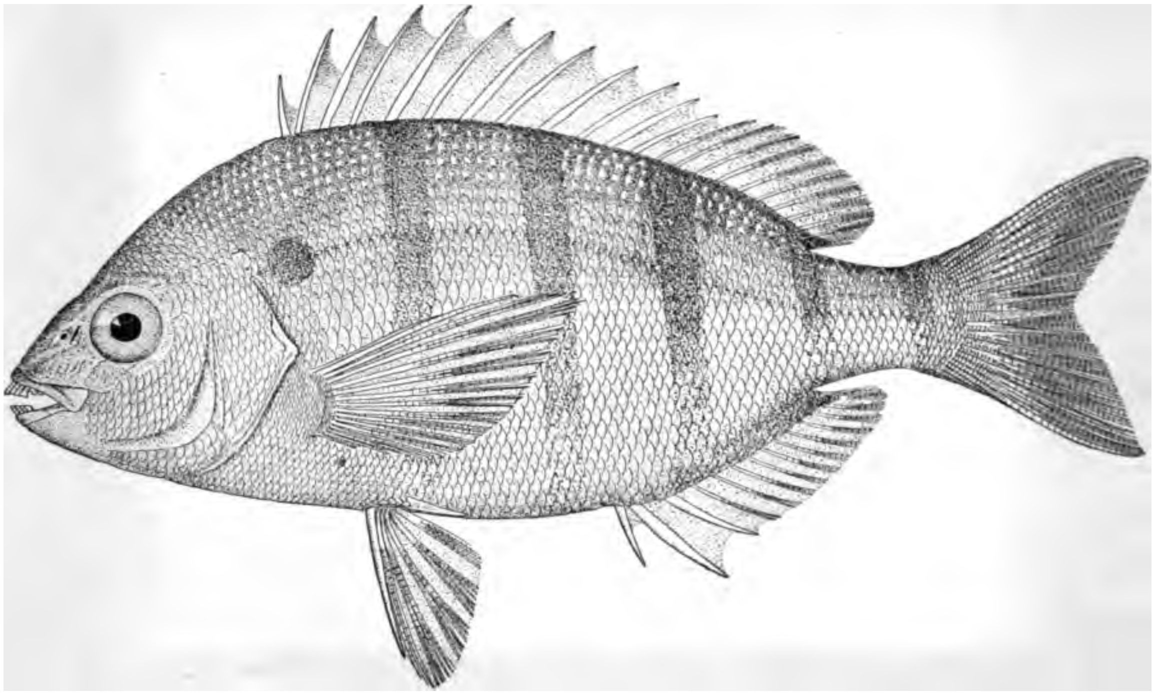
DIPLODUS HOLBROOKI (Bean). *Pinfish; Bream.* **Pinfish; Sailor's choice; Spot-tailed pinfish (N. C.); Ring-tailed bream (S. C.); Salt-water bream (S. C.).**



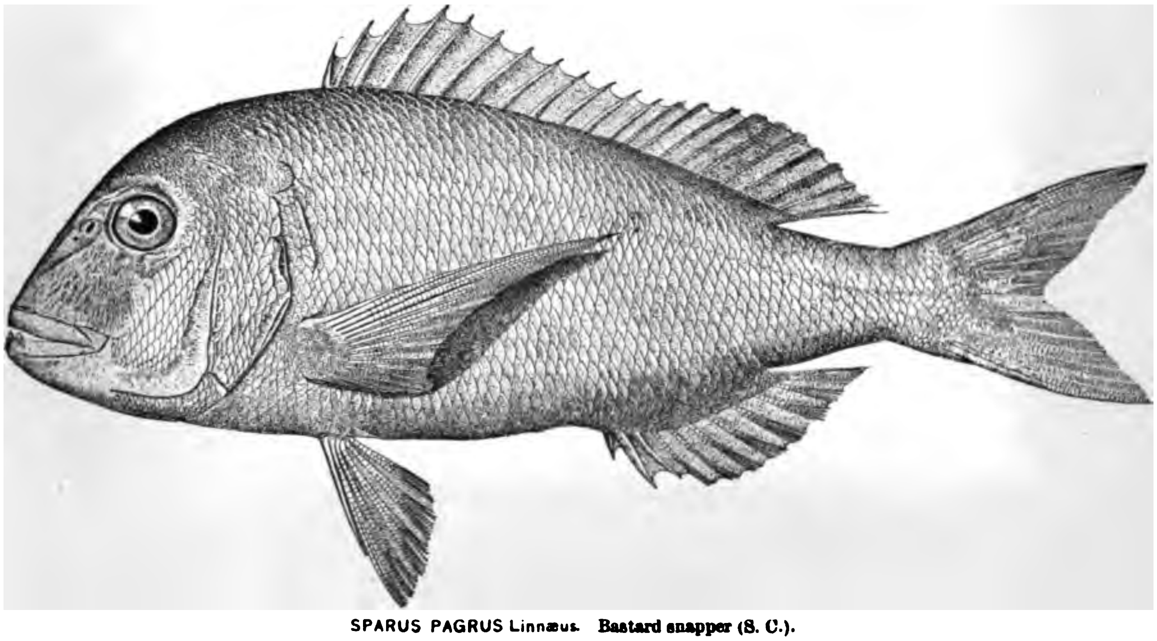
STENOTOMUS CHRYSOPS (Linnæus). *Northern scup; Porgy.* Porgy.



STENOTOMUS ACULEATUS (Cuvier and Valenciennes) *Southern scup; Porgy.* Porgy.

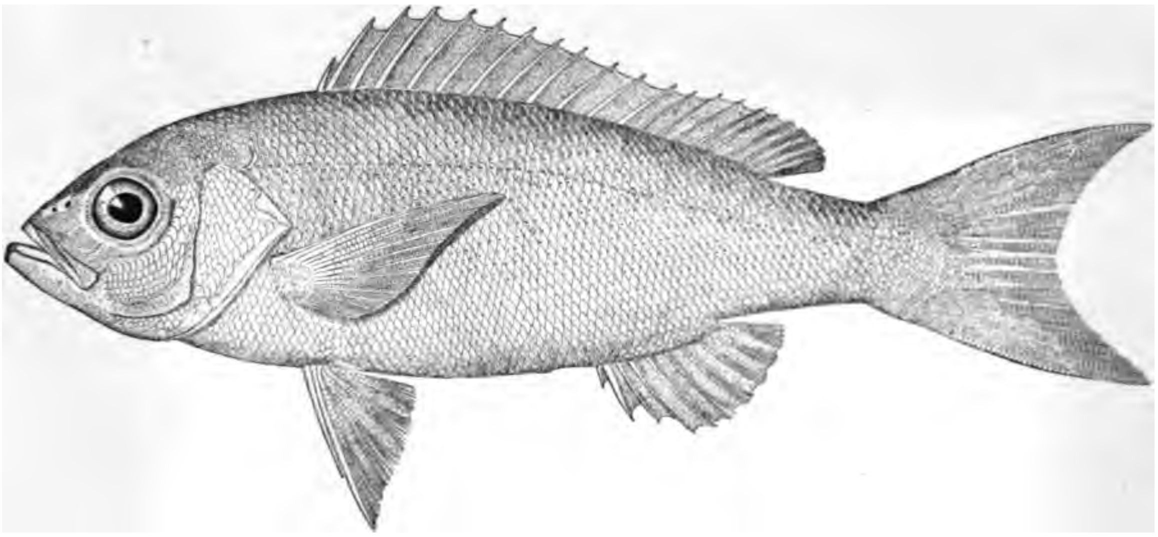


LAGODON RHOMBOIDES (Linnæus). *Sailor's choice; Bream; Pinfish.* **Robin (N. C.); Pinfish (N. C.); Salt-water bream (S. C.); Squirrel-fish (Ga.); Sailor's choice (Ga., Fla.); Scup (Fla.); Yellow-tail (Fla.); Porgy (Fla.).**

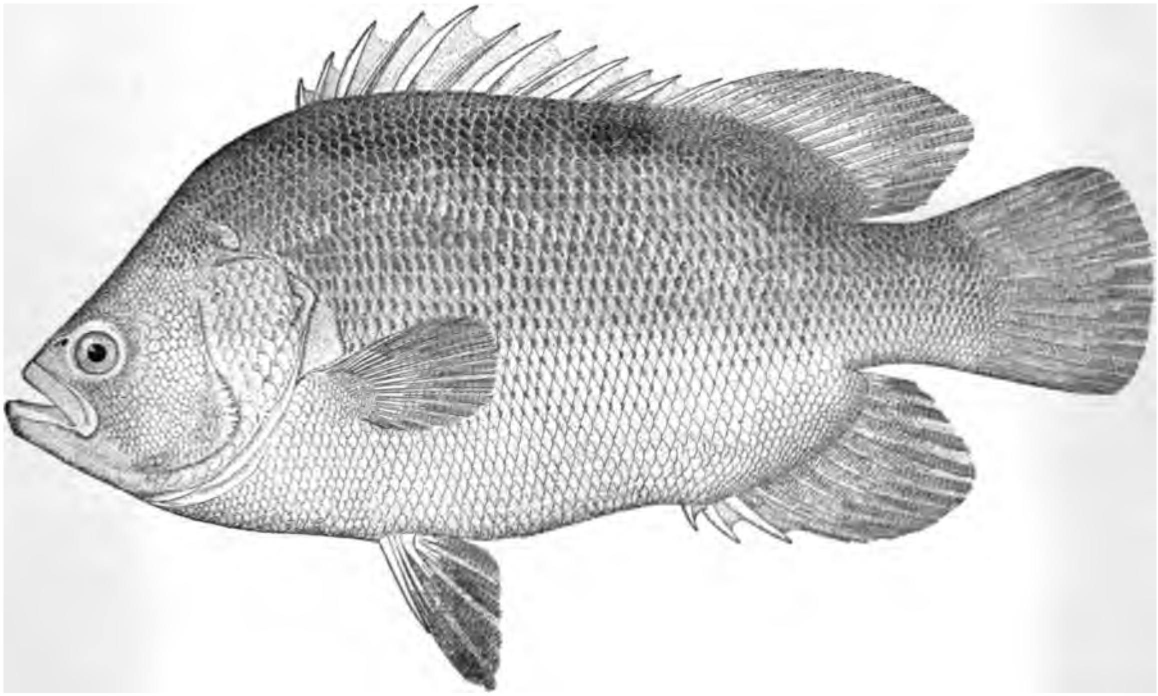


SPARUS PAGRUS Linnæus. **Bastard snapper (S. C.).**

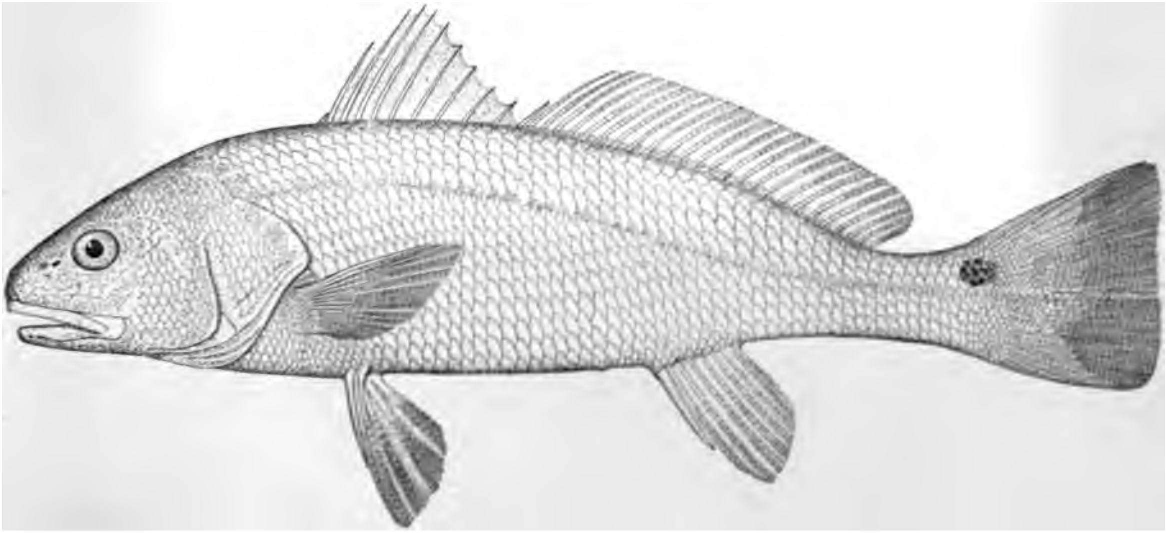
PLATE LXIX.



RHOMBOPLITES AURORUBENS (Cuvier and Valenciennes). *Mangrove snapper.*

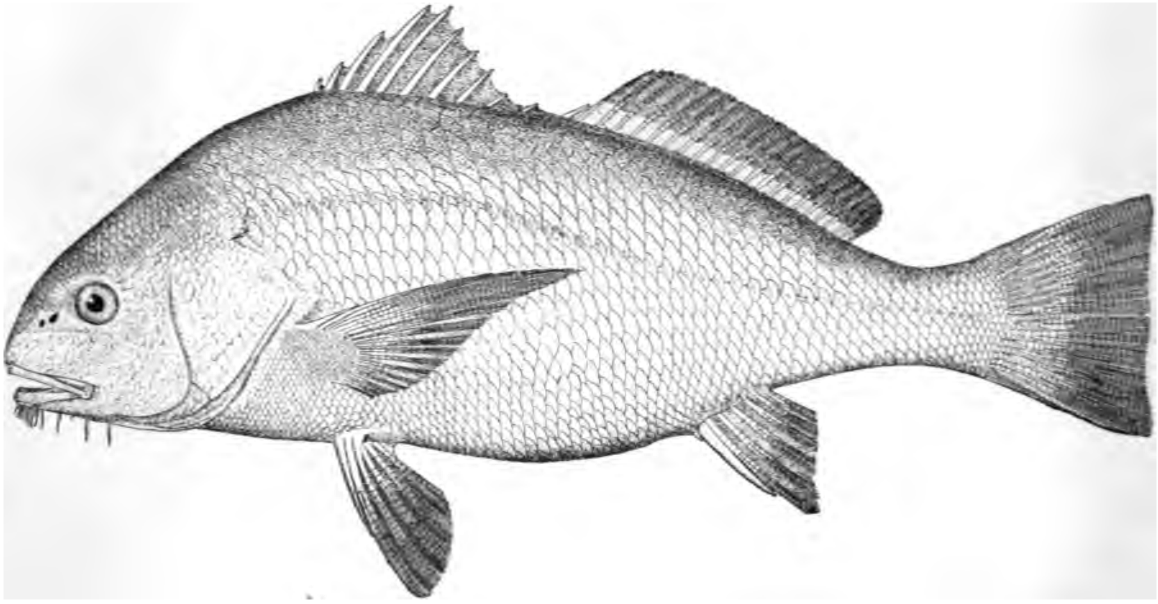


LOBOTES SURINAMENSIS (Bloch). *Triple-tail.* Sea perch (S. C.); Black perch (S. C.); Grouper (Fla.).

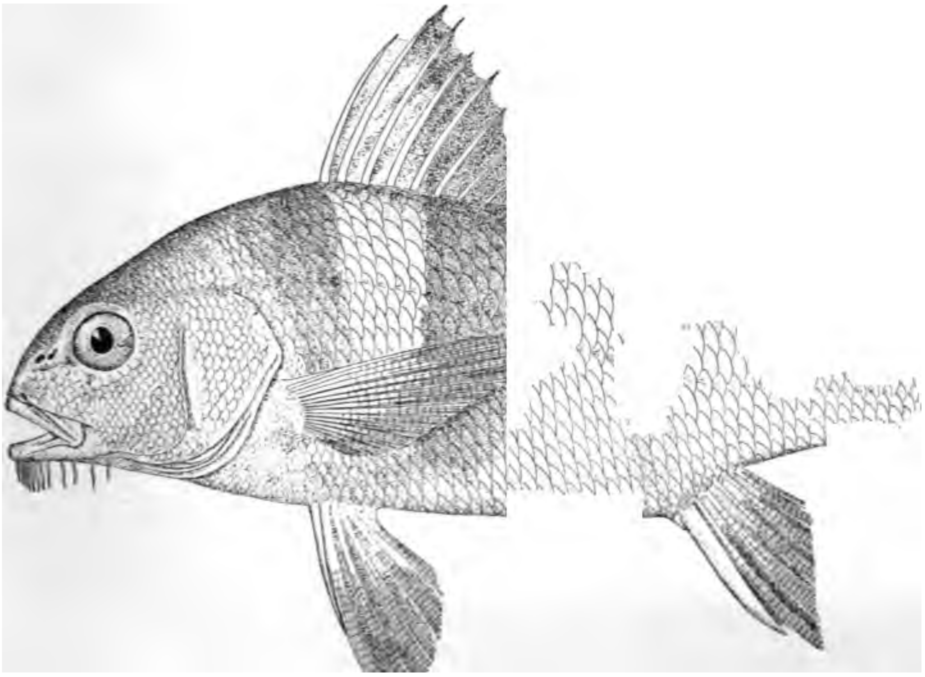


SCIÆNA OCELLATA (Linnæus). *Red drum; Redfish.* Drum; Channel bass; Red drum; Bass; Sea bass; School bass; Reef bass; Spotted bass; Red bass; Puppy drum (young, N. C.); Branded drum (S. C.); Redhorse (Fla.).

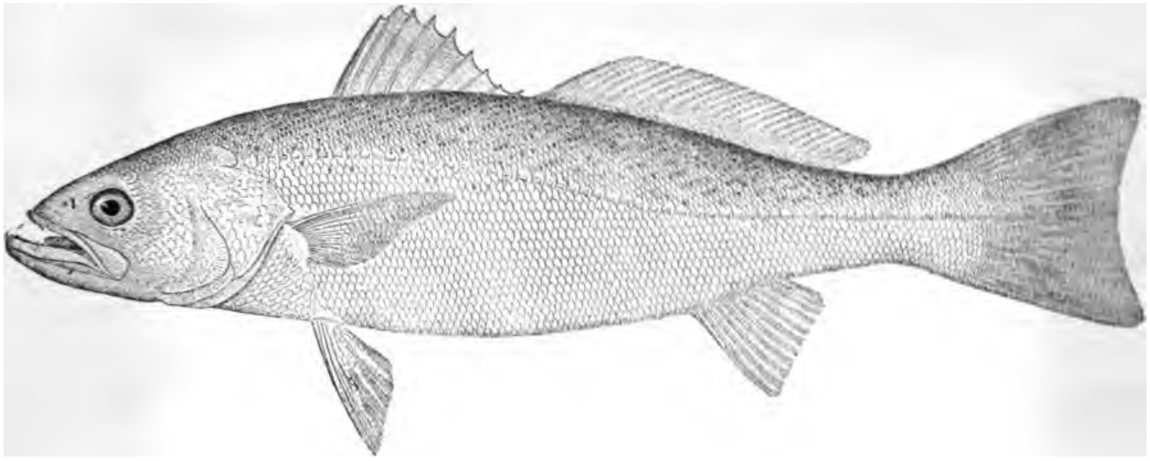
Bull. U. S. F. C. 1891. Fisheries of the South Atlantic States. (To face page 356.) **PLATE LXX.**



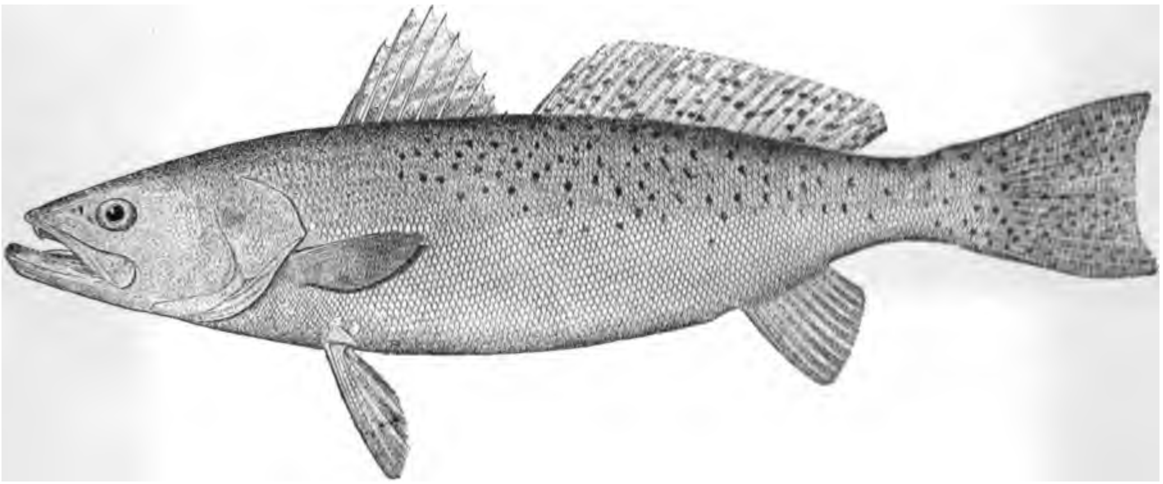
POGONIAS CROMIS (Linnæus). *Drum* (adult). **Drum; Black drum; Sea drum (N. C.).**



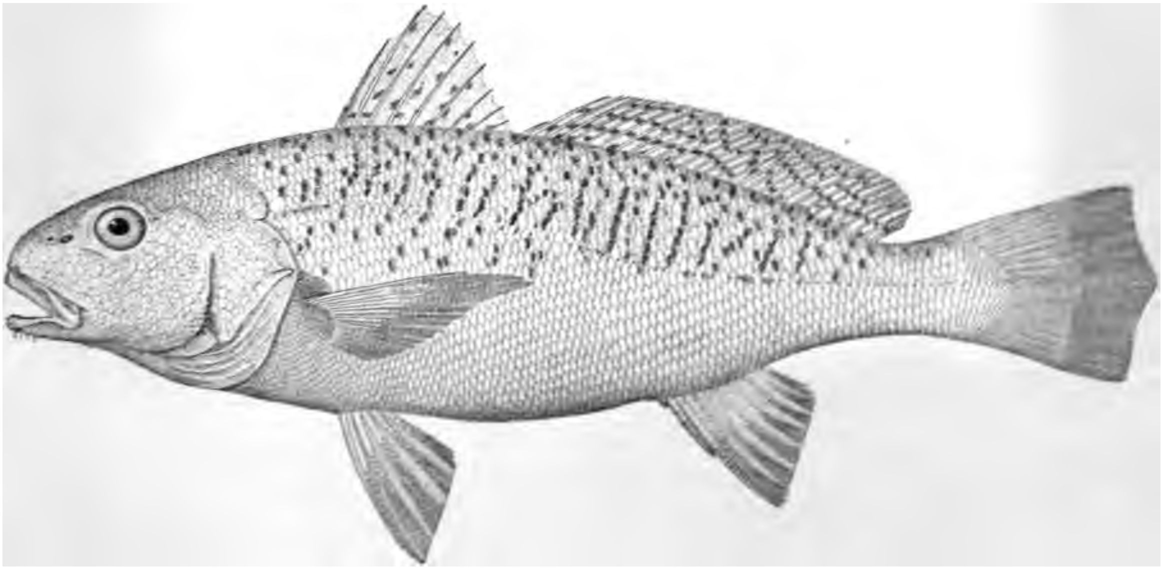
POGONIAS CR (Linnæus). *Drum* (young). **Drum; Striped drum; Sea drum (N. C.).**



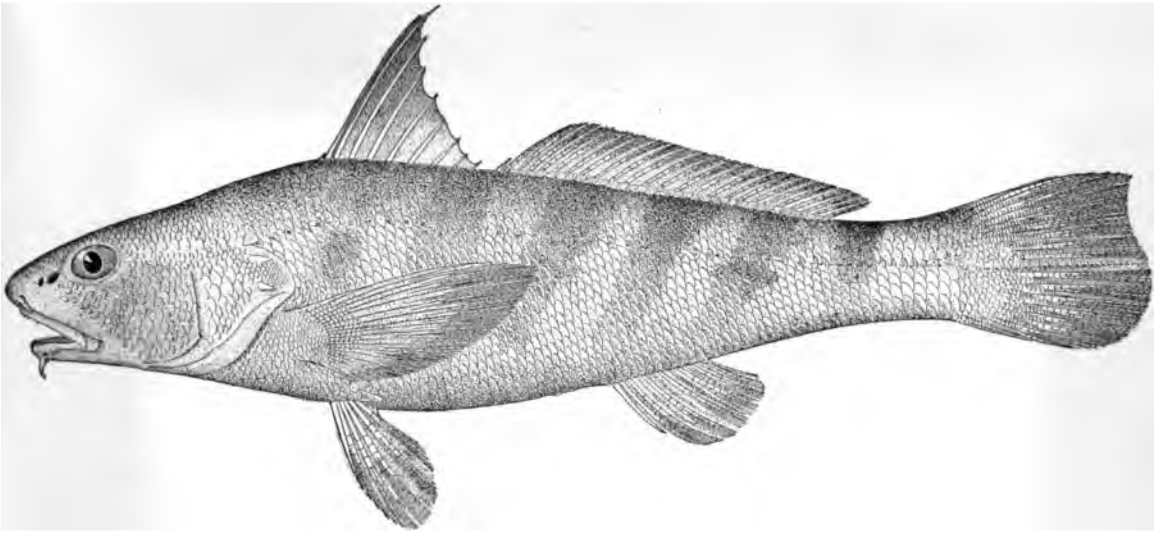
CYNOSCION REGALIS (Bloch and Schneider). *Squeteague; Weakfish.* Trout; Sea trout; Salt-water trout; Gray trout; Sun trout; Shad trout; Deep-water trout (S. C.); Yellow-finned trout (S. C.); Black trout (S. C.).



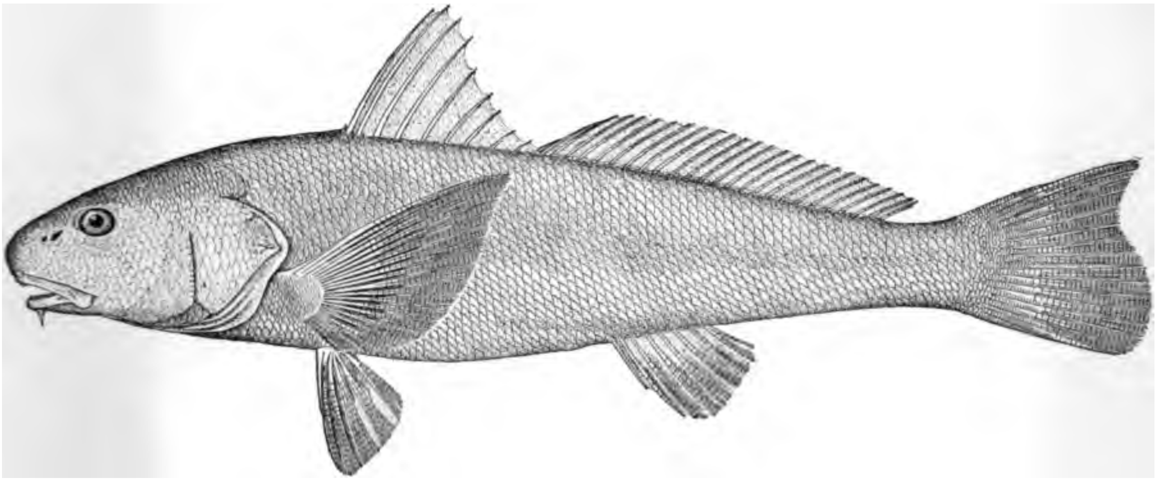
CYNOSCION NEBULOSUS (Cuvier and Valenciennes). *Spotted squeteague; Spotted weakfish.* Trout; Sea trout; Salmon trout; Speckled trout (N. C.); Spotted trout (S. C.).



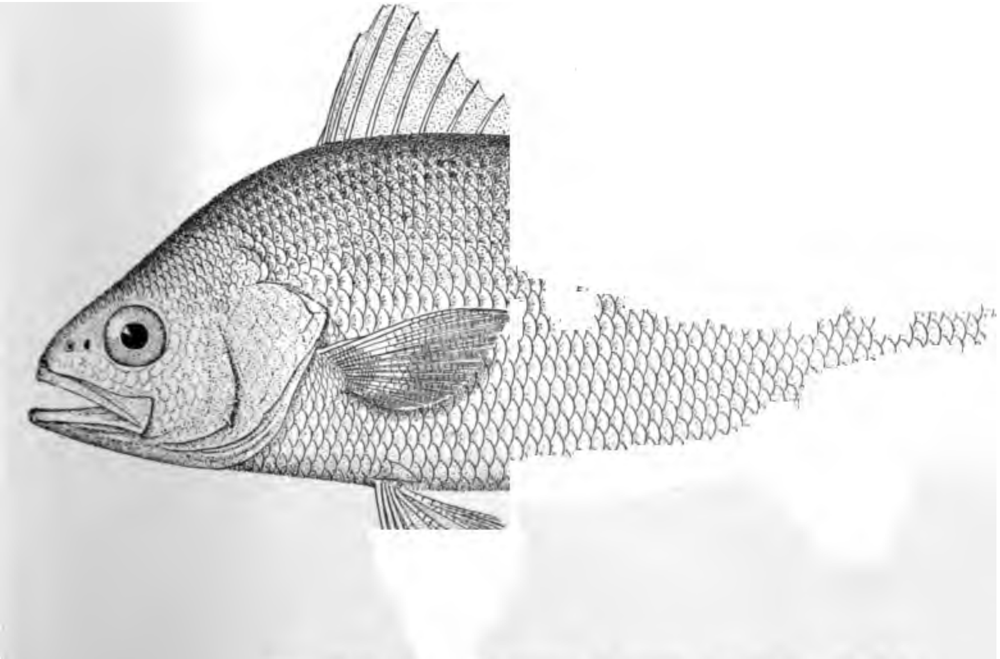
MICROPOGON UNDULATUS (Linnæus) *Croaker.*



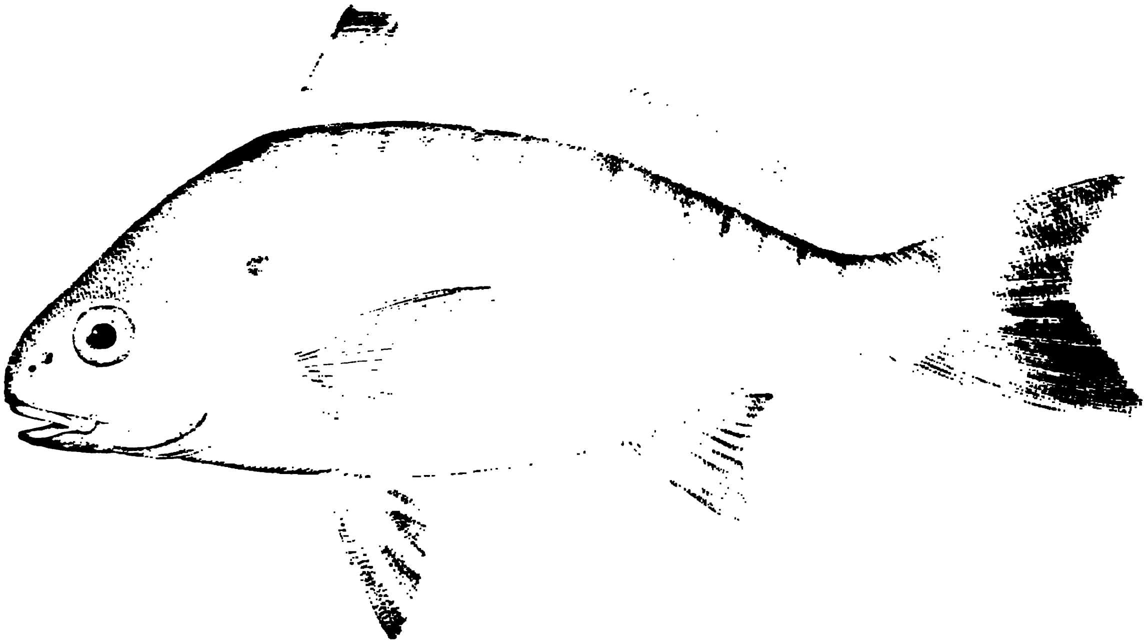
MENTICIRRHUS SAXATILIS (Bloch). *Kingfish.* Whiting; Sea-mink (N. C.).



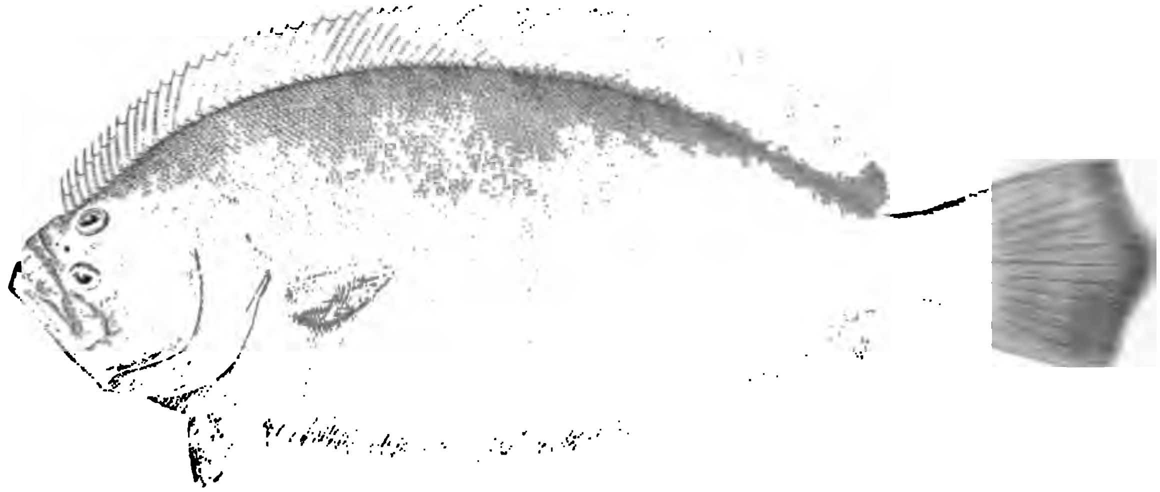
MENTICIRRHUS AMERICANUS (Linnæus). *Whiting; Carolina whiting.* Whiting; Sea mullet (N. C.); **Deep-water whiting (S. C.); Kingfish (Fla.); Bull-head whiting (Fla.); Barb (Fla.).**

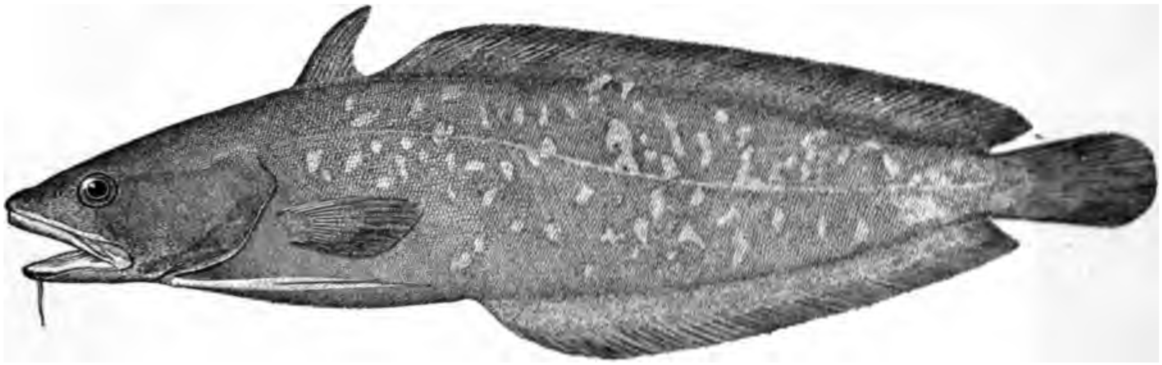


IRDIELLA CHR (Lacépède). *Yellow-tail.* Yellow-tail; Perch (N. C.).

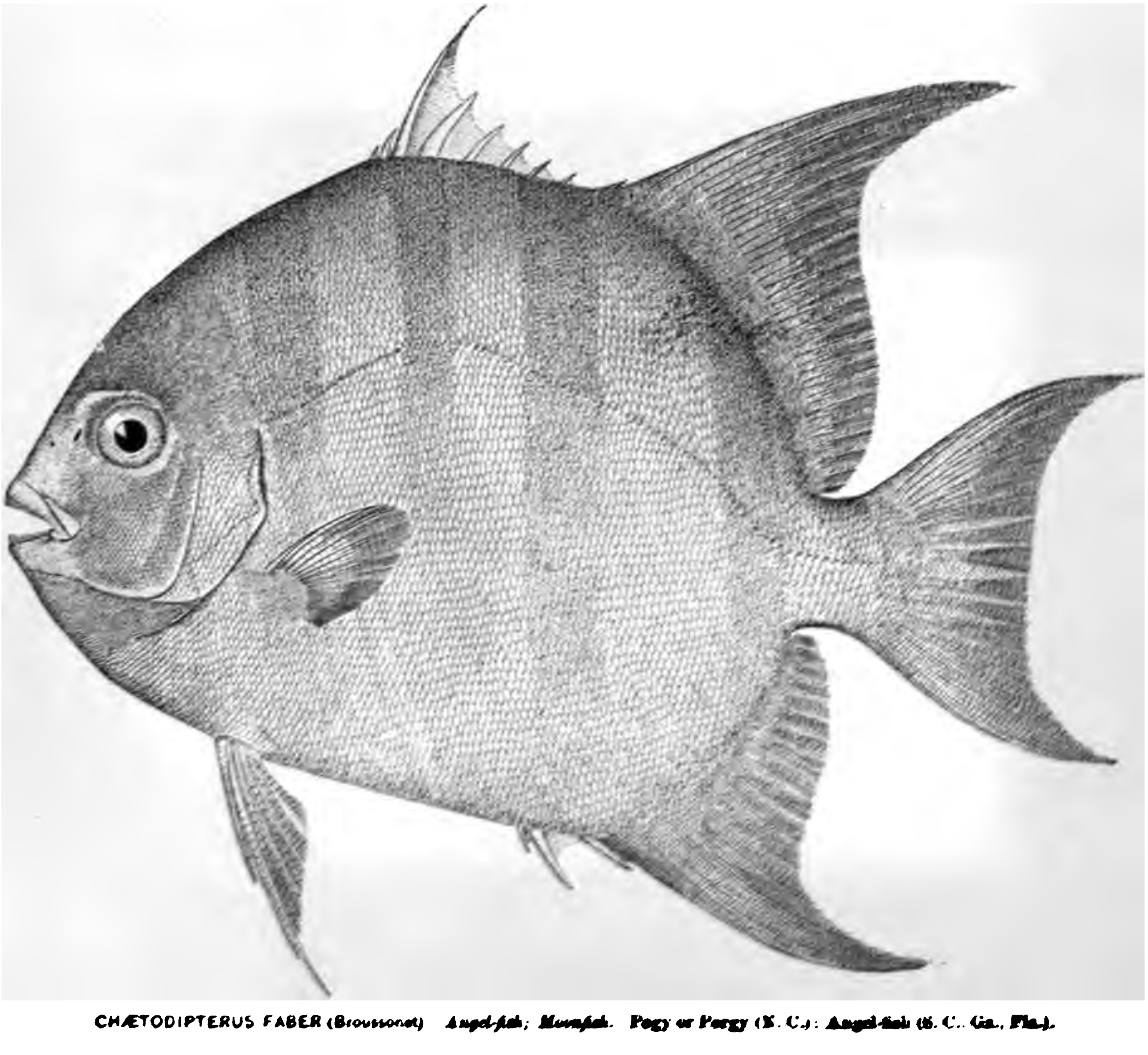


LEIOSTOMUS XANTHURUS [illegible] Spot. Spot; Jimmy [illegible]





PHYCIS EARLLI Bean. *Earll's hake.* Hake (S. C.); Tomcod (S. C.).



CHÆTODIPTERUS FABER (Broussonet) *Angel-fish; Moonfish.* Pogy or Porgy (N. C.); Angel-fish (S. C., Ga., Fla.).

9—REPORT ON THE EUROPEAN METHODS OF OYSTER-CULTURE.

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INTRODUCTION.

Oyster-culture as practiced in France has already been considered at some length in the publications of the U. S. Fish Commission,* most recently in a report by the writer,† summarizing the information obtained during the summer of 1891 in his visits to the centers of the industry in France. The present report, prepared under instructions from the U. S. Commissioner of Fish and Fisheries, Col. Marshall McDonald, is intended to complete a review of the European system of oyster-culture. The methods in use along the ocean coast of France are, in general, similar to those of the neighboring countries. It has, however, seemed important to understand the cultural modifications rendered necessary by changes in climate, shore characters, and saltness of water. Local conditions may not unnaturally have favored one particular locality to such a degree that methods of culture there in use might prove of little value in other and even neighboring regions. By general comparison a more distinct idea may be obtained of the actual character and extent of artificial culture. Thus may be seen by what manner and means one country of Europe has taken advantage of the practical successes of a neighboring one, has modified processes to suit local conditions, found by experiment to what limits imported methods might be carried, and succeeded or failed in securing the most judicious governmental aid in obtaining concession of cultural lands and in preserving the natural supplies of spawning oysters.

Of course, it is no easy matter to state all the reasons why, for example, if one system of obtaining seed oysters has succeeded most profitably in France, the same system should not have succeeded along the German coast or in England. But it is certainly reasonable to expect that by contrast and comparison of local characters, processes in use, governmental aids and restrictions in a number of countries, the general causes and general effects may, with the greatest probability, be induced. As to European legislative measures, a comparison, more or less general, has been attempted, and a few deductions which appear especially suggestive have been emphasized in the conclusion.

In the present discussion oyster-culture in the following countries will be considered: Italy, Spain and Portugal, Germany, Holland, Belgium, and England.

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* U. S. F. C. Bull., 1890, list of references, p. 385–388, numbers 9*a*, 23*b*, 37, 47, 49*b*, 70*b*, 79, 82.

† U. S. F. C. Bull., 1890, p. 362–388.

OYSTER-CULTURE IN ITALY.

Modern oyster-culture seems to have been derived from Italy.[*] Before the visit of M. Coste to Lake Fusaro in 1853, but little had been done in France to regenerate an industry almost on the verge of extinction. The report of Coste pictured the successes of the cultural processes of Italy and strongly urged their introduction on the French coast, causing the institution, under the patronage of Napoleon III, of a series of experimental measures, out of whose successes and failures has grown one of the most important of the coast industries of France.

Especially interesting is the fact, already shown by Coste, on evidence furnished by pictured funeral vases, that the processes in use to-day at Tarente or in the lakes near Naples are apparently the very ones that the Romans employed as early as the time of Marius. The oyster stakes of the Lucrine Lake, we are told, represent in appearance and actual position the very ones that Pliny may have inquisitively examined, little thinking that their use would be handed down to posterity more carefully than the volumes of his lifelong work.

Everyone who has written of Roman oyster-culture has referred to Sergius Orator as the inventor of this branch of industry. It would seem, however, from evidence that has endured two thousand years, that this wealthy Roman represented little more than a successful culturist of his day, noteworthy, perhaps, because a patrician. His prominence, too, as a successful culturist has been accented by a remark of the orator Lucius Crassus, who, as his lawyer, defended him in a suit for trespass against the state in the matter of oyster property; his time-honored pleasantry that the question of a few feet of land made no difference to his client, who could, if necessary, raise oysters with success on the thatches of house tops, has given the grasping Sergius more credit than he perhaps deserves. Certainly the oysters from the Tarentine Gulf were very early known, and were by historic evidence planted, doubtless with method of culture, in the lakes near Naples. Tarente, as a Greek city of ancient wealth and commercial relations, is far more apt to have had oyster-culture than was Sergius to invent it.[†]

The modern industry is carried on extensively only at Tarente. It is here that the major portion of the seed oysters are produced which are afterwards cultivated in the bays and tidal ponds of the southern coast and supply the general market of Italy. The gulfs at the north do not appear to be favorable to the growth of the typical European oyster, *Ostrea edulis*. The Gulf of Genoa produces a small oyster, mainly for local consumption, *O. plicata* (more probably *Ostrea edulis* var. *plicata*), a species delicately flavored and appearing to find its best living conditions in waters as dense as 1.027 to 1.028. In the harbors of Trieste[‡] and Venice another variety of oyster occurs, *O. edulis venetiana*. This is generally regarded as poorer in quality than *edulis*, and its production, therefore, competes but little with the more southern industry.

Tarente (or Taranto) has been rich in its fisheries from the earliest times. Its shallow gulf, opening broadly to the Mediterranean on the southward, shelters its shore life, but readily renews its supply of water. At the head of the gulf, protected by prominent ridges, is the small deep-cut and almost landlocked bay that has for ages been famous for its oysters—the Mare Piccolo. This is literally a small oyster-bearing sea, in every way comparable to the artificial one at the Sables d'Olonne. Its walls are its shelving sides, its floodgate is its constricted outlet into the gulf, one made still narrower by an outcropping island of rock—the ancient city and castle of Tarente. The Mare Piccolo is an oblong mass of water about 7 miles in major diameter, whose greatest depth is scarcely more than 40 feet. Its basin in general is saucer-shaped, with a bottom of firm calcareous sand, holding a depth of water especially favorable for purposes of cultivation, averaging perhaps from 3 to 4 fathoms. This remarkable shallowness tends not a little to maintain the water temperature, during the greater part of the year, warmer than that of the gulf beyond. The large surface for evaporation, in view of the small volume of water, would naturally lead one to expect an extreme density. As a matter of fact, however, this condition, which would undoubtedly be little favorable to the oysters' spawning, does not occur. The density of the water mass is, on the contrary, found to be uniformly low, as the fresh water entering the basin more than compensates for the loss caused by evaporation. A considerable part of this freshened water is derived from the small streams incurrent from the north. In this region, too, submarine springs are known to be present; of these the Citrello, which emerges near the Convent di Rosa, is especially remarkable.

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[*] As to the independen [illegible] origin [illegible] collectors in Connecticut, see Ingersoll, Oyster Industry, Tenth Census, 18[illegible]

[†] For discussion of [illegible] culture, v. Philpots' "Oysters and all about them." Richardson, London, 189[illegible]

[‡] Soubeiran, Bul. So[illegible] 1870.

The direct benefits of the tempering of water in these portions of the Mare Piccolo may be seen in the number of parks here. The specific gravity along this northern range of parks was found to vary (April 24, 1892) between 1.022 and 1.023 at 60° F.; to the southward and westward, about a mile distant from the outlet, the density had risen to 1.027 at 59° F.

As one approaches the city of Tarente on the railroad from Brindisi, a very good idea may be obtained of the extent of oyster-culture as the road bends around the shore of the Mare Piccolo. As far out as one can see the bay is bristling with oyster stakes whose ends project several feet above the surface. (Pl. LXXV, Fig. 1.) These are soon observed to pass into distant perspective in regular lines and to mark off the water surface into squares as of a checkerboard. These inclosures, which in France would be called oyster parks, measure about 15 feet square. They are leased at about 50 cents a year, and each culturist secures as many as he can cultivate. They are rented from a joint-stock company which has obtained from the city council the leasehold of the entire bay bottom, surveyed out in about twenty sections, for an annual sum of $10,000. The minuteness of the subdivision of this area is the result and also the cause of competition, and the energy of rival culturists adds much to the success of their industry.

The Italian is the very opposite of the French system of oyster-culture. French proprietors cultivate the shore lines between the levels of high and low water; their parks are embanked inclosures holding a few feet or inches of water until the tide advances; they cultivate their shores in a horizontal plane. The Italians cultivate oysters in all depths of water and make the number of oysters fattened in a given park stand in proportion to the volume of water. Having but scanty fall of tide, their system has become *vertical* oyster-culture. To cultivate horizontally the French have hardened their muddy beaches, have inclosed tidal areas, and have spread miles of flat cases of iron gauze to furnish growing space for their oysters. The Italian culturist has devised every means of supporting his oysters in the water volume between bottom and surface. In France, owing to unfavorable local conditions, the industry is minutely subdivided. A park of several hundred acres may be devoted to collecting the seed oysters, a second park may be of value in growing the oysters, and a third may serve to fatten or prepare them for transport. A Tarentine park may represent every branch of the industry; in an area of 15 feet square a culturist may collect the young oysters, grow, fatten, and prepare them for the market.

The Italian process may best be understood by referring to the accompanying sketch (Fig. 1), which illustrates a Tarentine park. It consists roughly of corner posts, a web of ropes and various suspended devices for collecting oysters (A), growing (B), fattening and storing them (C).

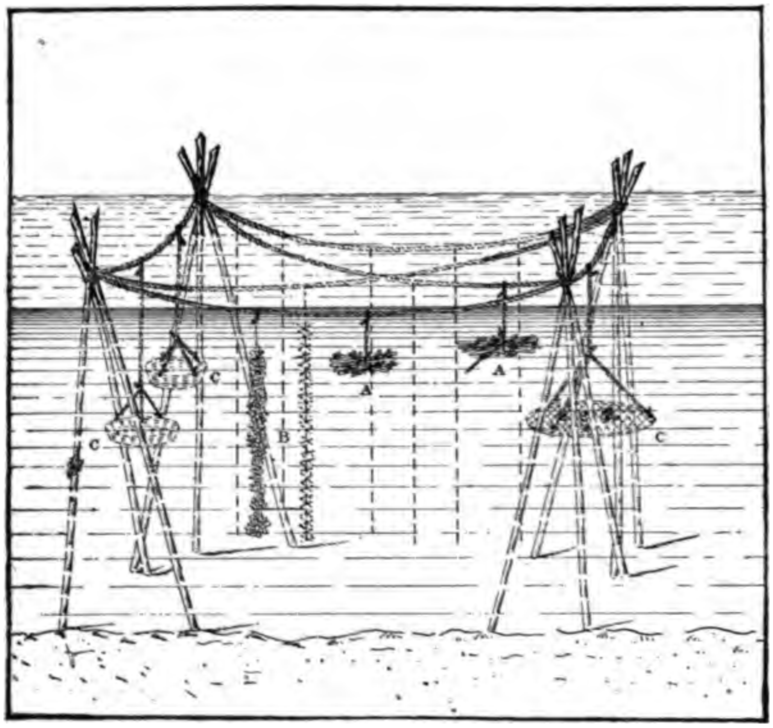

FIG. 1.

The corner posts, firmly implanted, mark the boundaries of the park. At each corner these are usually arranged in pairs, as seen in the figure, somewhat inclined toward each other and lashed together a few feet above the surface. Thus fixed they appear to be quite permanent, especially as their displacement by storm is not usual on account of the sheltered nature of the Mare Piccolo. The firm calcareous character of the bottom allows the posts to be readily inserted by blows of a heavy mallet. The posts themselves are of green pine, 6 or 8 inches in diameter, are not costly, and are apparently never tarred. The depth of the harbor allows their average length to be about 20 feet. In deeper water two or even three require to be spliced together, bringing, therefore, into culture a depth as great as 40 feet. The ropes forming a network between the corner posts must support the weight of the collecting devices (A and B). The cordage must therefore be strong and durable in water. A wire-grass rope an inch in diameter is manufactured in Naples for this purpose. It lasts for one or two seasons, and costs about one-half cent per yard.

The arrangement of rope may best be understood by referring to the accompanying diagram (Fig. 2). The supporting ropes are rarely exposed, except where attached to the corner posts. In the parks established in deeper water the matter of rope management becomes more complicated. The greater amount of rope required by the weight of the cultural apparatus has suggested an arrangement which both separates the cross ropes from each other and enables them to be more easily turned at the corners, as illustrated in the figure. With so light a scaffolding to support the devices for collecting and growing the young oysters, it is evident that the question of the weight of apparatus has been a very important one. For this reason, as well as on account of lack of tidal ground, the tile, as a device for collecting the young oysters, has been found unsuited. Wood, on the other hand, has advantages in point of lightness and cheapness. The loose bundles of hazel or gorse boughs, termed fascines (A, Fig. 1), become quickly water-soaked and form the most convenient collectors. These, when covered with young oysters, may be broken into twigs and woven into ropes, which, when suspended, utilize the water volume from surface to bottom (B). Oysters that have become detached and fallen to the bottom, together with grown oysters, may be placed for storage and final growth in the suspended baskets (C).

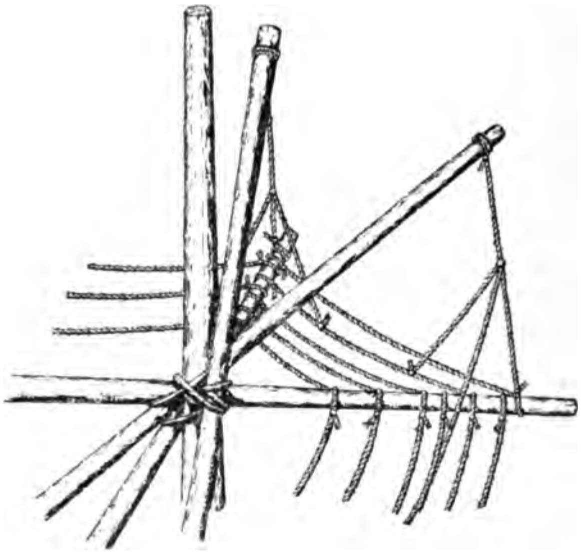

FIG. 2.

Thus outlined, the method of culture and its conditions may be more carefully examined. The supply of breeding oysters which furnish the spat is in any event a large one. The myriads of half-grown oysters lodged upon the suspended ropes spawn prolifically, and this supply is one that never decreases. A second source of spat is furnished by scattered oysters and beds of oysters that have either escaped the knowledge of the culturist or are difficult to secure. General dredging is but little practiced. The largest supply of scattered oysters is said to be in the immediate neighborhood of the parks where dredging is impracticable. It is certain that the spawning season in the warm waters of the Mediterranean is an extended one, stated by the proprietors to extend from April to October. The greatest set, however, occurs about the end of June. It was clear, however, from fascines that had been put down in January, and which were examined by the writer in April, that spawning had taken place during the colder weather, and it may in consequence be inferred that the spawning continues intermittently throughout the year. The development adventitiously of a portion of the generative product by lobes of testis or ovary has already been commented upon in the case of the American oysters along the southern coast of the United States.*

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* U. S. F. C. Bull. 1890, p. 352.

The fascines, freshly prepared during the winter, are by degrees taken out during March, April, and May, and anchored in deeper water, often in clusters marked with buoys. In the early season the outgoing currents are said to be usually the most fruitful in spat, and the culturists arrange their fascines so that they may best be utilized. In May, when the spat is beginning to form in shallower water, the fascines are usually taken up, well rinsed, and, as they are now water-soaked, are suspended in the little parks as shown in the figure. It is here that the fascines get their second crusting with spat, often becoming whitened with accumulated oysters. They are allowed to remain in the better conditions for growth given by the shallower and warmer waters until late in the fall, more often until the following spring. By this time[*] the oysters have firmly attached themselves to the support, the shells often growing around the slender twigs of the fascine, so that they are apt to be naturally detached, even if the underlying bark has been loosened.

It is not until early in the following spring that the fascines are taken ashore and deposited in huge banks, as a preliminary to weaving the ropes. The attendants now proceed to take them apart, chopping each bough with its attached oysters into twigs about 8 inches long (Pl. LXXVI, Fig. 1). The oyster twigs are now deposited in baskets and are carried to the next attendant, who splices them ingeniously between the strands of rope, so that when completed the twist of the rope, together with increased weight, keeps the twigs firmly in place. Thus arranged, the rope bristles symmetrically with its oyster-bearing burden. Cargoes of these ropes are then rowed to the parks and put in place. The growing conditions of the oyster now become especially favorable. The heavily burdened ropes swing and vibrate in the currents, allowing each oyster to escape the accumulating sediment and to secure an equal share of the volume of floating food. Their growth is certainly rapid; an oyster three-fourths of an inch in diameter in March, when suspended to the rope, has attained by October about four times its original diameter, and has thus become marketable. Two years and a half, however, are generally allowed to produce an oyster of first grade in the Tarentine market.

Another advantage the culturists claim for the rope system of culture is the ease with which the entire product of a park can be overhauled, cleared of attached ascidians, mussels, and bryozoans, and, in general (the oysters being in plain sight), guarded from more dangerous enemies. It is evident that rope culture economizes space to a wonderful degree. A single rope 14 feet in length is said to rear about 2,000 marketable oysters. The baskets, seen in the sketch, p. 360, are an essential part of the Italian method of culture. In these, stray oysters collected from the bottom, as well as grown oysters taken from the ropes during the process of overhauling, are given their final growth. Storage is thus conveniently managed, the capacity of the baskets being more or less accurately known. The baskets vary considerably in shape and size, the most usual form being loosely woven and shaped like a cheese-box.

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[*] The length of time that the collections are allowed to remain in position appears to be largely dependent upon the character of the season. The collectors from deeper water that have been rinsed and placed in the parks are often added to, if the season appears promising, by fresh fascines anchored in series and allowed to rise to within a yard or two from the surface. This degree of submergence appears to have been found most favorable for set. At this depth it is certain that the attendants can most readily give them the necessary care. They are clearly seen from above, are readily secured by a cross-barred staff, brought to the surface, rinsed of sediment, and replaced.

Another device used in giving the oysters their final growth is a net-covered iron ring, which, often having a large diameter (5 feet), may support four or five hundred oysters.

An important branch of the industry at Tarente consists in the export of seed oysters and of oysters of nearly marketable size which are intended for fattening in other localities, *e. g.*, Fusaro. Seed from half an inch to 1 inch in diameter sold during April, 1892, for about 30 cents per 1,000. The price of oysters two years old was then about 80 cents per 100. The average number of marketable oysters produced from each fascine is said to be about 500. The total production of the Tarentine industry can hardly be stated. An estimate based upon the production of four single parks would give the annual yield at about 20,000,000.

Compared with the industry at Tarente, oyster-culture in the historic parks near Naples is decidedly unimportant. A brief discussion of Fusaro and the Lucrine Lake should, however, be given as representing the best types of private industrial establishments and as illustrating the tidal pond culture of Italy. They are both within a few hours' drive from Naples, and are not over a couple of miles apart. Fusaro, the more northern, shelters under the promontory of Cumae, while Lucrinus, whose size was greatly reduced by the upheaval of Monte Nuova in 1538, is close to the Roman Baiæ. The entire region is one of great interest to strangers, and the inns in the neighborhood of the oyster parks owe not a little to those who evade Pozzuoli, hunt Roman villas, and are inclined to dine upon oysters, seriola, and falernian.

Fusaro, described by Coste in 1859, had its industry destroyed about ten years later, partly from volcanic causes and partly by lack of proper cultural care. Its decadence was caused, according to M. Bouchon-Brandely,[*] who visited Italy in 1879, (1) by the decomposition of organic accumulations which empoisoned the water; (2) by overcultivation of mussels; and (3) by excessive salinity of the water caused by the opening of the second outlet from the lake into the sea. Oyster-culture has, however, been successfully reinstated by Sr. Salvatore Milosa during the past decade. The present conditions of the lake and the methods pursued in its reëstablishment are therefore of interest.

Fusaro[†] is crescent shaped, with canals communicating with the sea at either end. It is large, about 2 miles in circumference, but shallow, averaging perhaps about 4 feet. Near the southern end, where the large hotel or *Casino Reale* is built, the water is deeper, shelving at points to about 2 fathoms. A greater volume of water was secured by dredging out the accumulated sediments, and has proved one of the great causes of recurring success in oyster-culture. The former shallowness of the water allowed its temperature to become excessive. The same process of clearing the basin aided the good results obtained by improving the ingress of a small fresh-water stream at the lake's northern end. By this means it became possible to reduce the salinity of the entire water volume, a cultural advantage which was recognized even in the time of Pliny.[‡] The water of Fusaro showed (May, 1892) a density[§] of 1.019 to 1.023, fresher than the neighboring sea by 5° to 9°. The temperature of a shallow lake like Fusaro would, in a warm climate, tend to become excessive, but it may readily be tempered by admission of water from the sea gate. Warmth in general is not looked upon as a serious stumbling-block to culture;* freshened together with slightly warmer water is said, in these regions, to give the oyster its best conditions for rapid growth.

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[*] U. S. F. C. Bull. 1890, in reference list, No. 93, p. 48.

[†] U. S. F. C. Bull. 1890, in reference list, Nos. 9*b*, 23*b*, 42, 50. Also Issel, Ostricoltura, Genova, 1882; Philpots', l. c.; Aldieri, Dei Laghi Lucrino, Fusaro e Mare Morto, Napoli, 1879.

[‡] Pliny (Bk. VI) records that oysters became larger and finer in the neighborhood of river mouths, and that they decrease in size and number in deeper sea water. There can be but little doubt that the value of Lucrinus was not a little dependent upon the less salty character of its water.

[§] Sp. gr. at northern end of lake, generally, 1.021, 79° F.; at middle of lake, 1.021 to 1.025, 80°; at south bank, 1.019 to 1.021, 79° to 82°; sp. gr. of neighboring sea, 1.028, 78°.

The industry at Fusaro is represented in the branches of seed collecting, oyster-growing, and fattening. The processes are practically those of Tarente. The water surface is broken with projecting stakes, especially numerous in the deeper part of the basin in the neighborhood of the pavilion (Pl. LXXV, Fig. 2). These are connected with a web of ropes supporting the fascines and baskets. About a thousand newly made fascines are annually brought into use and suspended in favorable spots for collecting, while those of the preceding year are removed and put in place in neighboring parts of the lake. The shallowness of the water renders unnecessary the weaving of the oyster bearing ropes of Tarente. At points along the bottom may still be seen the little pyramids of stone recorded and figured by Coste. These do not appear to be regarded at the present day as valuable collectors. The management of Fusaro as a closed lake at the time of the spawning of the oyster has been only partly successful. The "mother oysters" are introduced in the early spring in the deeper water, but it has not apparently been possible to retain the spat-laden water in the sense that it had been retained at Brénégny.† Higher temperature has doubtless its effect in rendering it necessary to renew the water frequently,‡ and during the latter part of May and the commencement of June, 1892, the water supply was renewed twice daily, allowing a large portion of the fry to escape. There can be little doubt that the problem in Fusaro is to study how long the water may be retained without endangering its oysters, the length of time appearing to be in direct proportion to the amount of collected spat. The surface area of Fusaro is not a small one, its depth is not great, and in favorable weather it would not be unreasonable to expect that natural aëration would allow the retention of the water for as long a time perhaps as several weeks. Further experiments in this direction appear to be needed.

The effects of seasons are extremely varying, and there can be little doubt that the time of fixation of the spat may, under the best conditions, prove as brief as several hours, although the idea given by Coste that the young tend to settle immediately in the neighborhood of the parent (*e. g.*, attaching to circumarranged stakes) was long since shown to be untenable. Spat collection is extremely irregular in Fusaro and the Lucrine Lake, and if one is to be guided by the suspicions of rival proprietors, a large part of their industry consists simply in *élevage*, the seed being brought from Tarente.

The rearing of the oyster is conducted economically. The oyster is allowed to remain upon the fascine until it is almost of marketable size, the base of the shell often becoming not a little roughened by its long contact with the wood of the fascine.

In Pl. LXXVIII, Fig. 1, will be seen a rearranged fascine showing oysters of a second year's growth. Oysters that become attached are usually collected and put for final growth in suspended baskets similar to those of Tarente. The French *caisse* of wire gauze, which would seem of great advantage here, does not appear to be employed.

The Lucrine Lake, although smaller than Fusaro, is of great interest from a cultural standpoint. Its establishment is carefully organized and maintained; its sea wall forms the highway to Naples; its heavy floodgate renews the water through a massive sluiceway projecting into the sea. (Pl. LXXVII, Fig. 2.) The present establishment would rival in quality, if not in size, its predecessor, famous in imperial Rome. Monte Nuova, which sprang up in 1538, is supposed to have greatly reduced the extent of the lake and destroyed its ancient prosperity by volcanic ejections. Lucrinus is rich in its associations, and is even to-day in the possession of the family of Pollio, which has long held the property, and may represent the Roman Pollio, whose villa, with accompanying collections of ceramics and slave-fed *murænas* was undoubtedly in the immediate neighborhood.

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* Bouchon Brandely, [illegible] p. [illegible], who records a temperature of [illegible]

† U. S. F. C. Bull., 1890, p. 8. ‡ Especially [illegible] the time of the dreaded hot winds.

Like Fusaro, Lucrinus has its waters perceptibly freshened, but its salinity can be better regulated. At one end of the lake a small canal leads a few hundred feet to a circular pond practically of fresh water, fed by bubbling hot springs (temperature as emerging, 104° F., sp. gr. 1.004); this is connected with a second basin of a bubbling spring (sp. gr. 1.010 at 90°) of slightly greater salinity. To these sources of freshened water should be added a deep spring in the neighborhood of the ateliers (Pl. LXXVII, Fig. 1). Lucrinus has but a single disadvantage in that its small size restricts its cultural limits, its extent being but about 10 acres. Proportionately its depth is greater than Fusaro, its basin shelving gradually to about 16 feet, and the bottom is less muddy, consisting mainly of tufa and sand. Its waters have a density of 1.0225 to 1.0245 at 79° to 80° F. Its temperature was the same as that of Fusaro, its greater depth and its constant communication with the outer water tending doubtless to maintain a greater uniformity in this respect. In the winter season the influence of the hot springs becomes of great service, favoring the growth both of the oyster and of its vegetable food. The proprietor of the lake, Cav. Domenico Pollio, favors the continuous introduction of sea water. The fall of tide (20 to 30 cm.) is sufficient to allow a proportion of water to pass out and to be replaced. This system has its effect doubtless in preventing the water volume from becoming either too fresh or too warm, and indeed the amount of the incurrent fresh water would render it decidedly dangerous to close the floodgates for any considerable time. It is, therefore, not remarkable that spat-collecting has never been permanently regulated. The yearly success has remained dependent upon favorable conditions of season, *i. e.*, a season producing a sudden and complete spawning, shortening the embryo's swimming stage, and reducing thereby the chances of the escape of the fry through the sluiceway.*

Culture is carried on by the usual method. The stakes, seen in Pl. LXXVII, Fig. 1, support a meshwork of ropes bearing fascines and baskets. Collectors of all varieties are brought into play, bunches of tiles roughly fastened together, and flat stones even being often included. *Élevage* is doubtless the cultural strength of Lucrinus, and the flattened wickerwork trays filled with half and full grown oysters are suspended at every possible point of support. The growth appears to be phenomenally rapid; a second year is said to be sufficient to produce an oyster 3½ inches in diameter. The Genoese oyster (*O. plicata*) is occasionally produced, being known here as the *Ostra reale*, and is exquisite in color and flavor. Other shellfish are naturally abundant in the basin, the *vongola* (*Tapes*) being of especial commercial value. The fish supply entering daily from the sluiceway during the falling tide is often of considerable value. The seriola, suggestive of Roman dinners, is especially abundant here. The straw runway which allows fish to enter and not to escape, will be noticed in Pl. LXXVII, Fig. 1, photographed from the bridge over the sluiceway.

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* Granting that an embryo would have a greater chance of escape in 48 hours than in 4 hours.

Before passing from Italy mention should be made of the oyster park in Naples near the Castello del Ovo, and the Santa Luccia. The former, checquered off with stakes and ropes, suggests a diminutive Tarente. Neapolitan oysters, however, have been brought to thrive where the water is not of the purest, and are therefore regarded with suspicion. Several cases of typhoid fever are recorded that appear to have been traced to this source.

OYSTER-CULTURE IN SPAIN AND PORTUGAL.

Two difficulties have stood in the way of developing oyster-culture in Spain. An extended seacoast has allowed local demand to be satisfied without recourse to artificial methods, and inconveniences in the matter of transportation into the interior of the country have prevented or retarded the development of regions where culture would naturally have become profitable. There is little in the way of technical devices to be learned from the study of the Spanish oyster-production, and in the present connection it will be of little value to discuss the matter at length. The chief localities which carry on production for the market of Madrid are Santander and Coruña. Both are on the northern coast, the latter near the northeastern part of the peninsula in the region of Cape Finisterre. At these points oyster-culture has been introduced after the French method.

The oyster industry in Spain is undergoing the same evolution that it has had in France. The northern coast, in its deep-cut and rock-built bays, has provided shelter for a large number of small, but very rich natural oyster banks. Such, for example, was that of San Nicolas de Neda, about 20 miles from Coruña, which was recorded in 1870 as having an extent of 2 square miles, or that of San Martin de Noya, 50 miles from Coruña, smaller, but exceedingly rich. These have been little protected by legislative measures and have been ruthlessly dredged, even by those who should have been their guardians. Their condition has finally become such that the market price of the oyster has become high enough (advancing within twenty years from 2 cents to $2 per 100) to insure the profitableness of artificial culture. The only reason, it is said, why the natural banks have not been entirely exterminated has been the rocky nature of the bays, which has hindered dredging. The demand for oysters in the French ports seems to have been the first incentive to overdredging.

The present need of Spanish oyster-culture is that of quick and low-priced transportation, which will place fresh oysters in the city markets at a not unreasonable price. By this means artificial culture will become more profitable. Spain is not wanting in industrial establishments. One, for example, in the bay of Lloregat, is well appointed and of considerable interest; unique, certainly, in making use of a windmill to renew the water of its high ponds. At Santander there is an establishment of the type of Arcachon, where case culture is carried on; in a sheltered part of the harbor the cases are arranged in rows and are rarely exposed, even at low tide; inclosures are not employed, and the cases are stout in build, supported about a yard from the bottom; growth is said to be exceptionally rapid and the oysters are usually marketed at the end of the second season. A similar establishment, about 20 miles to the eastward, has been quite successful in production. The intense saltness of the water,* sp. gr. 1.027 to 1.028 (68° F.), doubtless tends to render general production unprofitable, and the absence of thrifty beds of spawning oysters in the neighborhood can not fail to have a similar effect. Seed oysters are accordingly imported, mainly from Arcachon, on account of cheapness.

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* U. S. F. C. Bulletin, 1890, p. 384.

Efforts to regulate the banks after the method of M. Coste were recommended and experimented upon by M. Graells,[*] by royal commission, unsuccessfully.

In the markets of Lisbon the only obtainable oyster is the species known generally as the Portuguese (*Ostrea angulata*). This species, introduced into France a quarter of a century ago and a little later into England, has proven of great commercial importance. It is hardy, prolific, and rapid in growth, and in cheapness of production it makes undoubted amends for its poorness in quality.[†] As this species has long been known to be related to the American oyster in sex character, it has seemed of interest to ascertain its native living conditions and to what degree it has been locally cultivated. The Portuguese oyster is described as occurring in river mouths along the west coast of the Spanish peninsula. It appears to attain its best conditions along the southern coast of Portugal, but may be studied not unfavorably near Lisbon in the widened mouth of the Tagus.

The harbor of Lisbon is a miniature sea, a mile or more in width and half a dozen miles long, its entrance being formed by a narrows a third of a mile wide and 2 miles long. The southern shore of this sea, opposite the city, is the home of the oyster; it has shallow water, curving beaches, and incurrent freshened streams. It commences at the narrows opposite the city markets, Cacilhas, sweeps southward, then eastward, then northward, where the river begins to take upon it the tawny color of the "*mer de paille.*" It would naturally seem from the constricted mouth of the river that the water of the harbor would be considerably freshened, as it doubtless is at certain seasons, but the included water volume is so great and the sea inlet so deep that the incurrent fresh water is not apparently felt within 10 miles of the coast. Eight miles from the mouth of the Tagus the density, on October 1 to 3, 1891, continued as high as 1.0235, at 67° F, while the bulk of the water appears to average 1.0245 to 1.025 (67° F). At the Lisbon custom-house, in the current of the narrows, the density reaches 1.0264 (67° F). A gravelly shoal extends from Cacilhas, fringes the southern shore, and furnishes the site of a natural oyster bed, very favorably conditioned. The water is here shallow for a quarter of a mile off shore; the bottom is a compact crust of sand, gravel, and tawny mud, though it is often exceedingly soft below; it is usually densely carpeted with a fine ulva, not enough to stifle the oyster growth and perhaps contributing to its support as a purveyor of oyster food.

From time immemorial the region has been rich in oyster production, and for years has not merely furnished the Lisbon market, but has been the center of active export. The original cargo that gave accidental origin to the French-Portuguese oyster was taken from this neighborhood. The ease with which the *angulata* could be collected, its cheapness and hardiness during transport, have for a long time made its export considerable. An English company a dozen years ago secured a fishery franchise and supplied the English market with Anglo-Portuguese oysters, shipping them in great quantity to the grounds of the Thames estuary and there fattening them for several months. This export was continued until the company became exceedingly prosperous and was, by the influence of rival merchants, deprived of its franchise. Portuguese companies have since had control of the natural ground and from lack of financial support have, for the past few years, been unable to promote the industry. The crisis in the financial condition of the Portuguese government has been in great measure responsible for this decadence, since money is readily invested at higher rates and with more speedy profits than in oyster-culture.

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[*] U. S. F. C. Bulletin, 1890, reference list, pp. 385–388, Nos. 42 *a* and *b*, 12*c*, p. 200; also Francisco Garcia Sola, Fisheries of Spain, Int. Fish. Exhibition, London, 1883; extract in Philpots', p. 693; D. F. Balaguer y Primo, Cria de los Peces, de Guesta, Madrid, 1878, pp. 47 *et seq.*

[†] U. S. F. C. Bull., 1890, p. 366; also in reference list, pp. 385–388, Nos. 7 *d*, 9 *c*, *d*, *e*, *f*, 12, 14, 37, 39, 51, 63 *a*, *b*, *c*, 82.

Portuguese cultural methods have always been primitive. Cheapness of product has as yet forbidden the introduction of artificial methods of collecting the young. The spat occurs naturally and in great quantities throughout the shallow water, attaching regularly to gravel, stones, shells, and even to seaweeds, in a way quite unlike that of the more delicate French oyster. The spat growing rapidly is, after several months, collected, together with its abundant "cultch," roughly sorted over, and sold in baskets as seed for distribution in the tracts of foreshore held in stated rental by fishermen. Culture, therefore, like our own, takes place in waters where the oysters are not seen and in general little attended to. The mean depth of water in culture is about 2 fathoms. The rise and fall of the tide (which becomes as great as 17 feet at lunar tides, averaging about 8 feet) is taken advantage of in the process of collecting the oysters, which is done altogether by hand, as far as the writer could ascertain. In the majority of instances the oysters after being raked are cleaned and taken to the market at Lisbon, where wholesale dealers arrange shipments for export. Locally, as in the United States, oysters are sold either in the shell or removed from it by bulk in fluid measure. The former are sold throughout Lisbon by itinerant venders, most picturesque and characteristic street types, tall, bronzed, bare-legged fishermen, whose cap with tasseled end hangs down at the side of the head, shouldering a stout pole with dependent salver-like baskets. The shell-less oysters are sold more cheaply, the price averaging about 2 cents per dozen. Oysters are not highly esteemed in Portugal and their use is said to be confined mainly to the lower classes. Like the American and unlike the French oysters they are not infrequently given over to cooking.

The living conditions of the Portuguese oysters have in part been already given. The water is slightly fresher* than the normal in the French localities, though by no means as fresh as that of American oyster-bearing waters. The favorable character of the bottom and the general absence of oyster enemies have allowed the culturist to scatter the oysters broadcast, without the expense of the wire-gauze cases, which have proven so necessary a part of the French industry. Some of the Portuguese conditions are curiously similar to those of the "raccoon" oysters of the southern Atlantic coast of the United States. The marginal oysters are not infrequently exposed to the air and sun heat, and the clustered condition is a usual one. This, as in South Carolina, has been largely the result of the muddy and unstable character of the marginal foreshore. The gravel and sand do not appear to be sufficiently consistent to fix the oysters firmly, and accordingly these appear to cluster in clumps of as many as thirty or more individuals. This cluster is apt to gain stability, its weight driving the undermost oyster as a wedge into the softer mud and firmly fixing it; shiftings of bottom and accumulations of gravel are both serviceable in banking around the implanted cluster and rendering its uprootment still more difficult. The individual oysters are, in addition, suited to their surroundings, often becoming, on account of their crowded situation, fingerlike in shape, with a narrow, knifelike projecting margin. A further advantage gained by clustering is doubtless that of better feeding conditions, not merely in being raised from the stifling seaweeds, but as less disturbed by bottom sediment stirred up by storms.

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*U. S. F. C. Bull., 1890, p. 366.

There can be little doubt that the Tagus, if undisturbed, would produce raccoon reefs as remarkable in many regards as those of May River, South Carolina. The comparison with raccoon oysters might even be continued further than in the irregular shape of shell, in its often thin, watery, and tasteless character caused by its exposed position. The color of the flesh, however, is not that of the southern oyster; it is an opaque blue white, often dark slaty, the fringing edge of the mantle, as already noted, being broad and jet black, the sense papillæ long and coarse.

It seems extremely significant that these two oysters, the Portuguese* and the Virginian in its raccoon variety, become remarkably similar when their physical conditions are paralleled. It is likewise noteworthy that the same natural method of culture, transplanting seed from shallow into deeper water, becomes also paralleled. There is apparently less difference between the typical raccoon and the northern oyster of the American coast than between the raccoon and the *angulata* of Portugal. The taste, the peculiar slaty tint, and broad sensory mantle rim of the Portuguese oyster are not discriminative. These characters appear to become acquired by the American species when introduced into European waters. The original quality of the American oyster appears to deteriorate steadily from the time of its introduction, and this species thus often attains a well-earned reputation for inferiority. The greater saltness of the European localities has been noted as one of the conditions that have rendered unsuccessful the introduction of the American oyster, and it certainly has an effect in checking the spawning habits, for in no instance has a well-authenticated successful spawning been noted in England, France, or the Netherlands. Where the American oyster has been introduced it has invariably lived, but has not succeeded in regaining its original quality. Where the density has been as low as 1.023 to 1.024, it has gained in flesh, but has become (*e. g.*, Arcachon, Jerseke, and Whitstable) of the opaque, clayey, Portuguese type, rivaling the Portuguese oyster in its peculiar taste.

The *angulata*, moreover, like the raccoon, when given the better conditions of deeper water feeding, and when transplanted in cultural processes, as at Arcachon, develops, as might naturally be expected, a long, regular, and well-shaped shell, almost losing its marginal, involuted angularity. The raccoon oyster becomes by cultivation creamy white, with a flavor not unlike the Whitstable *native*, but the *angulata* assumes its slaty color and coarseness in texture and taste that have very naturally rendered it of inferior commercial value. On this account it is not the most thankful task to compare the Portuguese to the American oyster—to suggest, in fact, that it is but a variety of the Virginian species. But it is not improbable, everything considered, that the *angulata* (derived perhaps at no remote age from the more generalized variety-forming American species), has been produced through the local agencies of feeding conditions and increased water density. It reverts most clearly to the American species through the raccoon variety, its plicated shell rim being not more than a variation of that of the less plicated raccoon. Shell plication, which has been made of such value in specific discrimination, can hardly be given great weight after its variation in this regard has been examined under natural conditions. For it may be found that (1) many shells are, if anything, less plicate than in some types of raccoons; (2) the plication may increase in number from three, angularly marked, to a dozen or more, faintly suggested; (3) the younger oysters are often comparatively smooth in shell characters.

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* Cf. Winslow, as to similarity in sex character and development, Rep. Com. of Fish. Md., 1881, p. 68; for *edulis* should be read *angulata*.

The oyster industry in Portugal is remarkable, inasmuch as it is prosperous although practically unprotected by law. Oysters are abundant and low in price, a result, however, which could never have been obtained had the demand been great enough to render it profitable to introduce improved dredging apparatus, with perhaps a consequent industry of canning. No canning factory, it is said, exists in Portugal. Lack of demand has also tended to deter innovations in culture.

OYSTER-CULTURE IN GERMANY.

In Germany, oyster-grounds exist in only a single district, the sheltered corner of the North Sea, where the coast line has almost reached the frontier of Denmark. As this area of natural production is a very restricted one, it may reasonably be inferred that it possesses exceptional characters and conditions which render impracticable the introduction of the French system of oyster-culture. Such a conclusion has been firmly maintained by Prof. Möbius, who, as the state authority in these matters, studied the conditions of the industry when the question of replenishment of the oyster banks was being agitated. His chief works, Ueber Austern- und Miesmuschelzucht (1870), Die Auster und die Austernwirthshaft (1877),* have become classic in the literature of oyster-culture. If his conclusions be altogether accepted, a number of corollaries to his proposition seem too important to be allowed to remain undiscussed. Thus, for example, it would follow that the success of the Dutch and French industries was dependent on exceptionally favorable local conditions, and that, therefore, the introduction of artificial methods into a foreign country might not succeed even when large natural oyster-grounds were in the immediate neighborhood, for it is to be remembered that the natural banks of Germany are the largest in associated series, if not the most productive, in all Europe.

As to the conditions of the oyster banks:† They occur, as has been noted, in but a single district, a corner of the North Sea which has been cut off and sheltered by a barrier of fringing islands. This included area is about 50 miles long and about 15 miles wide, extending due southward from the Danish frontier to beyond the line of the ancient town of Husum. Its sea wall, protecting not a little the low-lying coast of Schleswig-Holstein from the storms of the North Sea, is formed principally of the three long, fringing islands, Röm, Sylt, and Amrum, in whose immediate lee occur the largest and most fertile of the oyster banks. The tranquil conditions which this considerable water area offered, with bays and sheltered coves, seem to have been from the earliest times not unfavorable to oyster growth; but doubtless its limits have been shifting and changing, tending to increase shallowness and to reduce the extent and sweep of its currents, and perhaps to make it less and less of an oyster sea. Its waters are not deep, the fall of tide averaging perhaps about 10 feet, at lunar tides becoming as great as 18 or 20 feet, and exposing hard sandy flats over the greater portion of its area. These have given rise to the name *Wattenmeer* (sea of flats or shoals). The flats occur largely on the side of the mainland, and the outrunning water, having to pass from the higher table-lands to the deeper North Sea, has cut wide and often deep channels bending between the islands. In all of these deeper areas are found oyster banks, sheltered as far as possible in the lee of seaward islands. Here the depth, normally between 10 and 30 feet, is sufficient to keep them covered with water even at the lowest spring tides.

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* Wiegandt und Hempel, Berlin, the latter translated in U. S. F. C. Rep., 1880, p. 83.

† Cf. Möbius, Die Auster und die Austernwirthschaft, I.

The location of oyster banks does not appear to be always, as figured by Möbius (Die Auster und die Austernwirthschaft, p. 5), on the steep-sloping side of a channel, but seems to be in every way similar in position to those examined by the writer at Cancale, Auray, and Arcachon, the banks being, in many instances, situated in the widened channel, often upon slightly elevated areas, the irregular limits of which can be determined by the sounding pole. The bottom, especially in the northern portion of the Wattenmeer, is firm and stable, a mixture of sand, clay, and mud, and that it is in the main favorable for oyster growth is seen in the lines of natural oyster banks which form almost a diagram of the deeper waters. At points, however, as in the channels of Amrum and throughout the southernmost parts, muddy areas occur; these are soft, often shifting, and are naturally unproductive. The flats have exceptionally shifting sands: they are in general hard and firm, readily sustaining the weight of a horse and cart. The rapidity with which the rise and fall of tide cover and uncover the extensive flats has been emphasized by Möbius as one of the unfavorable conditions of the region, causing harmful accumulations of sediment and general shifting of sand and mud. On the other hand, it can hardly be doubted that the sediments continually deposited from the landward shore, *e.g.*, from the Husum River, would accumulate very seriously but for these currents. Where the outgoing currents are the strongest there apparently exist the most favorable conditions of bottom for the location of oyster banks, as Möbius has noted.

The water conditions of the Wattenmeer are directly comparable to those of Arcachon in point of saltness, the normal density being about 1.024; this degree has already been noted as possessed by the chief centers of oyster culture in France* and in Italy, especially in regions that have proven favorable for production, *e. g.*, Auray, Arcachon, and Tarente. A table of densities prepared by the writer during his visit to the Wattenmeer shows, moreover, that the waters from Sylt down almost to the mouth of the Husum canal vary surprisingly little in density, even at different tides, the temperatures remaining almost uniform. This uniformity in the water density was not expected in view of the rapid filling and emptying of the basin, and is somewhat difficult to account for, suggesting a surprising regularity in the incoming volumes of freshened and salt water. It is noteworthy, perhaps, that the small freshened streams that contribute to reduce the density of the entire water volume appear to be distributed very evenly along the landward margin.

The oyster banks number about fifty. Their length varies from a few hundred feet to a mile and a half, while the breadth averages hardly more than a few hundred feet. The exact position of each is accurately known by means of ranging sights, and the government, as will later be noted, examines their condition yearly and determines which are sufficiently rich to be dredged from.

We may next briefly examine the way in which the oyster banks of the Wattenmeer have been managed. They have certainly been retained in productive condition at a time when those of other countries have been destroyed. The policy in their administration has been eminently conservative, aiming (1) to preserve the banks rigidly, to guard the terms of leasehold against overdredging, and (2) to favor in every way maximum productivity in natural areas, rather than to experiment in lines of artificial culture or to allow the tidal lands to be held in favorable leasehold for this purpose.

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* See table of densities in U. S. F. C. Bulletin 1890, p. 384. The densities were taken at about the same season of the year. The total difference in densities at various stations in the Wattenmeer during different tides (48 hours) is not greater than sp. gr. 0.001.

Historically the banks have been, for three centuries, the property of the Crown. The Danish Cronicle, published in Husum in 1652, shows that even at that early date their positions had been determined, and they seem to have been surprisingly similar to those of to-day. Under the late Danish rule the management of this domain was a lenient and apparently a prosperous one, probably in part because unaffected by railroad transportation. The last company under this régime, a Flensburg firm, is said to have rented the fishing franchise for an annual payment of $17,000, and to have been allowed to fish unrestrictedly. The company, strange to say, conservative in its management, feared to injure the prosperity of the grounds and allowed only a stated annual amount to be dredged. When the property was transferred to the German Empire about 1866, the dredging franchise passed into other hands, and again in 1879 the Prussian administration caused changes to be made in the holding, as well as in the terms of the lease of the fishery, bringing the details of management more than ever under the direction of the state. A reservoir with buildings intended for storage and fattening of oysters, located at the mouth of the Husum Canal, which had been constructed by and formed the headquarters of the former lessees, was now purchased by the government and became a supervising station. A guard or inspector was to be stationed here, under direct supervision of the Baurath at Husum, and two patrol sailing vessels and a small government steamer were to make their headquarters in the neighborhood. The arrangement of this reservoir station is an interesting one and will be discussed later.

The leasehold now to be granted was carefully devised to prevent overfishing of the banks, requiring (among other stipulations, which are hereafter given) that each bank be yearly examined by a committee which should include a government authority, in this case the Baurath at Husum. No more than the exact number of oysters thus designated should, under heavy penalties, be taken; all oysters should be brought to the government station at Husum to be counted, and to insure that no undersized oysters had been removed. The lessees, having the exclusive right of fisheries, were to pay the government a percentage on the total number of oysters allowed to be taken. Under the stricter terms, the leaseholder (for twelve years), after two years' exploitation, declared that the industry was profitless, that the banks were deteriorating and that he wished to cancel his lease. To this, however, the authorities would not consent, but a compromise, aiming to regulate the banks, established a complete close season for ten years (expiring 1891) and allowed the lease to continue from the end of this period. The lessee seems to be little more than a fishery contractor of the government, and it is not surprising that in his management he has resorted to similar contracting methods. He thus contracts to pay the dredging vessels, about ten of which are usually employed, a percentage upon their catch—a price averaging about $4 per ton (700 to 800 oysters). The catch is paid for when delivered at the station at Husum. The governmental tax of about $14 per ton (up to 3,000 tons) is now imposed, and the lessee must pay the freightage to the railroad station at Husum.

which again by contract adds nearly $1 to the price per ton of the oysters. The lessee has finally full liberty as to the selling, the market price being more or less determined by the price and duty of the Dutch and English oysters. The price at the Husum station varies between $3 and $4 per 100 oysters.

From a practical standpoint it is to be noted that on the governmental side in this system of leasing oyster property the state is assured that the natural grounds shall not be destroyed and that the single contractor is thus made directly answerable for excesses. On the other hand, it would be seriously questioned by the French or Dutch culturist whether this monopoly in management would be most profitable in the end. It certainly does not tend to reduce the price of oysters, because it does not favor the granting to individuals of concessions for cultural purposes near the natural oyster banks. It is certainly the antithesis of the open competition in oyster-culture which has furnished the coasts of France and Holland with one of their most prosperous industries. The French reserve the natural banks merely as a source of seed oysters artificially collected in the neighborhood. The German industry exists solely upon the annual surplus of its natural supplies.

The question why the same system of culture which has proven so successful in France should not have been successfully introduced in the Wattenmeer is thus important both as a biological consideration and a matter of governmental policy. Prof. Möbius, after a consideration of the matter, has urged the following reasons why all efforts to extend oyster-producing areas and to introduce artificial culture would be lacking in practical success. He states in summary that the unstable character of the bottom of the Wattenmeer, together with the sediment-bearing water, is the most adverse condition. This restricts the natural limits of the oyster-bearing areas, causing any increments to be temporary at the best, and renders it impracticable, from the point of expense, to solidify areas for the extension of the natural banks. His second reason is that the biological conditions of the Wattenmeer are so exactly poised that the oyster supply can not be permanently and largely increased, mainly on account of failure in quantity of oyster food. And third, the reason which is indorsed by Dr. Hoek, that the coldness of the northern winter, together with the remarkable storm tides, renders cultivation impracticable.

As far as the silt-bearing character of the water and the muddiness of locality are concerned, it is certainly of interest to note to what a remarkable degree these natural difficulties have been overcome by French culturists during the past decade. Production as well as *élevage* is brought to yield practical results in localities which were recently thought to be less than valueless, where neighboring oyster beds not merely did not increase, but were able to exist only by vigorous culture. Even in regions most favorable for production the adverse condition of muddy shore lines is not infrequent, and appears in fact to be far more general than in the neighborhood of the islands Sylt, Amrum, Röm, or Föhr. Prof. Möbius has already commented upon the muddy character of the Arcachon basin.* In the Auray region, in the neighborhood of the natural banks, a large part of the tidal shore has so little consistency that if tiles were placed there they would be instantly engulfed. These localities have, however, been reclaimed by a more or less recent process which forms a surface crust, macadam like, to give a suitable support for the collectors and their manipulators. This process, as at Kergurionné, though costly, has proven of practical value, as can be inferred from the extensive continuance of the practice. The very general use of the champignon collectors in the Auray (Morbihan) region is alone significant of the muddy character of the water, which renders of the utmost importance the question of determining the exact time to put the collectors in place. In fact in all of the French regions of production silt deposit goes on so rapidly that the tile when in position is said to retain its value but little longer than a week; it is to be noted that even during this short time its upper surface has become unproductive and that the undermost tiles in many of the forms of collectors are very slightly, if at all, spat-bearing.

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* Ueber Austern- und Miesmuschelzucht, 9–12. The discussion here given of the natural conditions of Arcachon leads one to expect anything but the development of a prosperous industry. We learn, for example, that "die grossen Erwartungen, mit welchen die künstliche Austernzucht im Bassin von Arcachon in Angriff genommen wurde, sind leider nicht erfüllt worden. In Bordeaux hörte ich aus zuverlässigen Munde, dass viel Geld dabei verloren worden sei."

Möbius maintains that the size of the banks in a given region can not be materially augmented—a matter which is of great interest even from the standpoint of pure biology. Not that it is at all to be questioned that a natural bank would under normal conditions remain more or less uniform in size and in the proportion of its component organisms—but it is the theory involved in this question that seems to the writer susceptible of broader interpretation than has been assigned it. *Biocœnosis* is the term applied by Möbius to express the mutual interdependence of species existing in a colony—a condition of happy-family existence in a natural cage whose limited food supply locks up the chances of permanent numerical increase. In accordance with this keenly poised life-balance Möbius infers that the banks of the Wattenmeer can not be permanently added to, even by artificial means (Auster u. Austernwirthschaft, p. 78). He notes, for example, that a season favorable to oysters, will, *per se*, cause the oysters during the following seasons to fall back to their normal, inasmuch as food material has thus been prepared for the enemies (crab and starfish) whose increased progeny will restore the balance of life.

The important inferences drawn from this doctrine of life-balance, do not, however, seem to be entirely warranted by the premises. We are led, for example, to infer that individuals are dependent upon the colony, and that the colony holds the curb, checking the permanent increase of one form at the expense of another. On the other hand, struggle for survival is undoubtedly the democracy of animal living, and in these days it has been pretty clearly established that the colony is but an incident more or less transient in the survival of the fittest. So the biocœnose, as we must accordingly admit, becomes but an episode in colonial life, whose duration depends upon the enduring force of its component species, where quickly moving predatory forms have the right of might, where stationary and defenseless forms have become mimics to escape their enemies, or have developed a surprising fecundity to survive the dangers of a compressed living-area or unfavorable environment. It can not at present be doubted that the scale of the struggle may readily be turned in favor of but a single type or species. Artificial devices may thus become the rapid undoing of the slowly struggling biocœnose, for they favor the protected species and would not unreasonably tend to blot out the accompanying enemies of this form.

Thus, in theory, an oyster protected from crab and starfish by a raised gauze-covered case gets thrifty feeding conditions without danger of becoming engulfed by mud or sand. The amount of spawn produced by the oyster thus favorably reared becomes increased, a far larger proportion of the young are secured by the artificial devices, and this progeny is so situated that their natural enemies may be watched and destroyed. Conversely, the enemies, thus artificially circumvented, find less nourishment, spawn less prolifically, and run continued danger of destruction from the traps of culturists. These results destructive of the biocœnose would none the less happen, be it understood, granting that the food quantum, as Möbius states, is an altogether limited one. But in the case of oysters living in what is practically an open sea, the food supply does not appear to be of the strictly limited character that Möbius has assumed. And his illustration of the carp in a small pond producing no more than a definite weight in annual yield, does not seem to be absolutely pertinent. Nor would the comparison be closely applicable even if the number of carp were supposed to be taken from the pond and set free in an open river. Their yield in weight would doubtless be greater, but even then fish food is not to be compared either in quantity or in capacity for exhaustion with the minute oyster food plant-life which is continually transferred through a limitless volume of sea water. The boundaries of a natural bank are certainly not fixed by food quantum. The food stuff may, it is true, vary in quantity in different regions during the same season, or in the one locality at different stations, seasons, or even tides.[*] But there seems in general to exist a food normal which is recognized as characteristic of a locality.

Aside, however, from this question of local variation, the amount of food that is actually brought to an oyster colony seems to the writer to be in direct proportion to the volume of water passing over it. If this volume be infinite, as it is in the Wattenmeer, exhaustion of food supply would seem an impossible condition. Barrenness and sterility of water could not occur; general transfusion of floating or of free-swimming micro-organisms is very clearly one of the characters of the open sea. The lower water layers that may have been screened out by a thrifty oyster bank would not remain without organisms, but would immediately be replenished from above by the currents that exhausted the lower layers. The writer had this impressed upon him in its practical aspect while examining the various cultural establishments of the French, Dutch, and Belgian coasts. The test in these instances seems a fairer one, since the side-dependent questions of sediment accumulation and danger from enemies is excluded by the cultural device of wire-gauze cases.

In a situation where the water volume becomes an extraordinary one, myriads of oysters are cultivated. At points where this water volume is increased by currents the cultural possibilities are found to become almost limitless. At Ossegor, for example, near the lower end of the lake, where the water is constantly changing, the cases were arranged in continuous lines, utilizing every available point,[†] each case containing about a thousand oysters, so tightly packed edgewise that it would seem almost impossible for them to open; yet growth and fattening under these conditions was in every way noteworthy. In localities where the proportion of normal food organisms is naturally high, a greater quantity of oysters can be raised in a given water volume, *e. g.*, Soudre, Whitstable, Ostend. In such localities the naturally high food normal may be artificially increased by conditions of *claire* culture, where a given volume of water is retained in ponds and given the best conditions for rapid increase of diatom life. Warmth, richness in plant food (Marennes), and a proper degree of salinity may give the forcing conditions of what might be likened to greenhouse culture. In some instances a remarkable number of oysters may be fattened in a fixed bulk of water. At La Tremblade so favorable are the conditions that in the shallow *claires* (whose water is renewed but once a fortnight, and whose depth averages less than a foot) fifty oysters are normally fattened to the square yard of bottom.

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[*] Cf. however, New York State Report of Oyster Investigation, 1886, p. 72 *et seq.;* U. S. F. C. Bulletin, 1890, 344–349.

[†] U. S. F. C. Bull., 1890, 375, Pl. LXXIV, Fig. 2.

In regions where the waters do not contain a high percentage of food organisms, culture in closed ponds is clearly unprofitable, as the water is both low in food normal and limited in volume. In instances of this kind it is understood that the two essential conditions, degree of temperature and salinity, have remained practically comparable; otherwise it is evident that from these causes, as much as from actual lack of food, the oysters may be restricted in growth. The instance that Möbius cites, that of the oyster reservoir at Hayling Island, as demonstrating that the oysters had exhausted the food supply and remained dwarfed in size, may, judging from the character of the locality, not improbably have been the result, and the sole result, of an exceeding saltness of the water. At Auray, in the neighborhood of the natural grounds, Möbius states that far more seed oysters are raised than can ever be grown to marketable size, on account of lack of space and food resources. Judging from what is now being done at Auray, the industry is profitable as purveying seed oysters for the parks in regions (*e. g.*, in Brittany) unfavorable to production. The experience of the Auray culturists does not favor the idea that the lack of oyster food limits *élevage*, but that efforts at collection are of greater advantage commercially.

The law of oyster growth, as stated by Möbius, seems, therefore, from the standpoint of the culturist, open to misconstructions: "Oysters are to be included in the same list with other animals; the sum of their entire mass is dependent upon the amount of food stuff which they obtain and store up,"* becomes truism. This might, however, be thought to imply that the number of oysters in a given river or bay might not become greater because their biocœnose appears to be perfect. Artificialization has demonstrated that the matter of food supply in natural oyster localities is of far less importance than space for culture and immunity from enemies.

Möbius, discussing the possibility of success in the French cultural system, concludes "that in all parts of the Wattenmeer, where oysters could find room and generate, there they already live. On all parts between the natural banks the swimming embryos as they settle, either on account of finding no point of support or through unfavorable living conditions, can not exist. The principal difficulties in obtaining a set on our (German) coast are those of sand or of mud burial."† It has already been shown that difficulties of this character have been successfully surmounted within comparatively recent years in France.

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* Möbius, Die Auster u. die Austernwirthschaft, p. 79.

† Möbius, Ueber Austern- u. Miesmuschelzucht, p. 43.

Möbius has, furthermore, supported his view that physical conditions have limited and will limit the size of the Holstein banks, by adducing the matter of percentage of increase. This he has determined by comparison of the number of oysters as fished from the banks to be about 421 "half-grown" to 1,000 "full-grown" oysters. This proportion, it will be admitted, determines the natural increase of the banks, but it can obviously have little to do with proving that artificial production in the neighborhood of the natural banks would be unsuccessful. The French culturist, on the other hand, might well suggest that this proportion of natural increase is a large one, since in French regions most favorable for artificial production the banks, so far from increasing, retain with the greatest difficulty the average number of spawning oysters.

The third reason given by Möbius for lack of German success in French cultural methods is the coldness of the northern winter and the severity of storms, often occurring when the tide is at its lowest phase. It is certain, as Prof. Hoek pointed out to the writer during a visit at the Helder, that the German coast is not far distant from the northern limit of the oyster, and that its natural increase, therefore, is less favorably conditioned. The dangers of the Holstein bank to direct freezing in winter, as Möbius has stated, may well be regarded on every side as formidable, especially in artificial production, where young oysters affixed to the collectors are to be retained during the winter. These dangers would appear, however, to render success with French culture costly rather than impossible, necessitating the transfer of collectors to deeper water or to localities that have proven safe, or, as in Brittany, providing special reservoirs for winter storage.

That natural banks exist even in great number in the Wattenmeer, and that the Danish banks, which are located considerably to the northward, appear to bear the cold and storms of rigorous winters with more or less success, seem to suggest that a provision for safely wintering oysters, even in the youngest stages, might not prove an impossible task. Indeed, if a good set of oysters were obtained in the German sea by the introduction of improved collecting methods, the use of suitable reservoirs, as those of the government station at Husum, which serve every year to harbor the marketable oysters during the coldest weather, might well be expected to provide safe winter quarters for the young.

The reservoir at Husum (Pl. LXXVIII, Fig. 2) is admirably devised and merits at this point a brief discussion. It was placed at Husum on account of transportation facilities, although its situation is in many regards unfavorable. Husum, as already noted, is at the southernmost corner of the Wattenmeer, probably at one of its most muddy shore points, and its low, rich meadows are strongly protected against storm tides by heavy fringing dikes. These, by an indentation, allow a wide canal to carry freshened water seaward, and thus provide a harbor for the fishing vessels of the little port. The slanting sides of this canal are of the softest mud, reminding one of the great canal at La Tremblade. Its waters, which become almost as salt as the outer Wattenmeer at high tide,* are allowed to pass through a sluiceway into the neighboring government reservoir. The fall of tide, averaging about 10 feet, is sufficient to allow the basins to be emptied daily.

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* At low tide (July, 1892) 59 1.013, at high tide 1.0235.

The following figure illustrates the care with which the reservoir is devised to deprive the water of its sediment. The great dike, which rises almost 20 feet above the normal water level in the basins, is pierced at two points; one, opening on the seaward side (A), feeds the reservoir (B), the other (C) is the outlet of the pond (D) destined for the storage (and fattening).

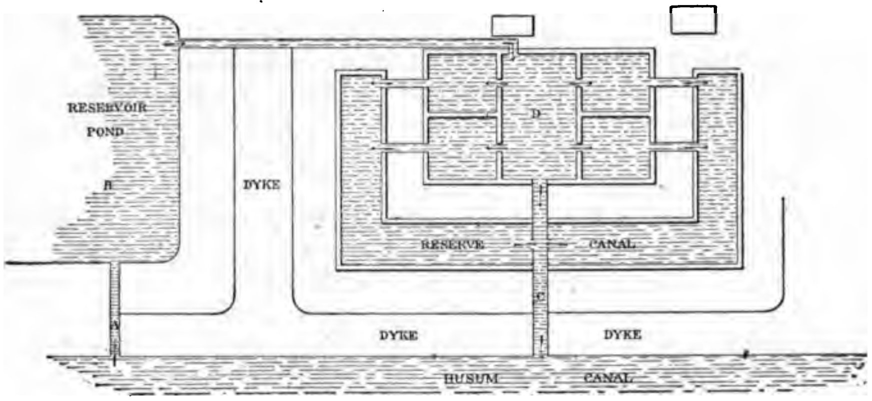

FIG. 3.

The oysters, it will be seen, do not receive their water supply directly from the muddy canal, but from the reservoir pond, where the water from the canal, after standing twenty-four hours, has deposited sediment. The storage pond (D) is subdivided as seen in the figure, and each compartment of the basin may, for convenience in handling, be emptied separately. The outlet gates, it will be noted, do not allow the water to escape directly into the canal without, but pass into a U-shaped canal, which, with boarded sides, is sufficiently deep to contain a reserve supply of water, intended for use in case the reservoir is in process of being cleaned. The main division of the storage pond (D) has a board bottom, raised a foot or two above the soil, through whose interstices the sediment shifts or is swept when the pond is being cleaned. Partitions about a foot in height divide the bottom into alleyways in which the oysters are arranged. These alleyways serve to separate different grades, and are of convenience in the process of washing the oysters. The side ponds, fed from the main pond, are similarly arranged as to the partitioned alleyways, though the bottom is of concrete, or rather of a heavy foundation of concrete veneered with closely fitted firebrick.

The management of these storage ponds is a simple one. The oysters during the dredging season (September 1 to May 8) are obliged to be brought to the station, and are at once transferred from the boat to the basin, to remain only until time of railroad shipment. Improvement in quality of the oyster during this stay in the basin is not taken into consideration commercially. There are apparently no attempts at fattening, flavoring, or "education" for transport, as practiced at La Tremblade. The ponds are daily filled and emptied, so that no time is given for the oyster food to multiply as in *claire* culture. In the neighborhood of Husum the low-lying country is suggestive of Marennes, in its rich sediment-bearing character as well as in the degree of salinity of its waters, and it would appear to the writer that experiments in well-managed *claire* culture (which have not apparently been made) might lead to interesting and perhaps important results.

To summarize, the oyster industry in Germany is entirely dependent upon the surplus of its natural beds. French culture has not been introduced in its behalf, but the writer does not consider it proven that this system is an impracticable one in the German waters, or that artificial oyster-culture is suitable for France and not for a neighboring country. The few experiments tried in Germany with regard to artificial collection have not, as far as the writer could learn, been in accordance with recent improvements. Tiles that have been put out in the neighborhood of the natural banks appear to have been arranged in single tiers, in a way that would have succeeded in the hard river bottom at Jerseke, but would never have been attempted in the sediment-bearing water of Auray. These tiles, placed upon a very muddy locality, were not unnaturally engulfed in part, and in part so covered with sediment that a set could not have been obtained.

The few experiments tried in the government station at Husum have signally failed, the usual fate of experiments upon production in small, closed ponds, where stagnation, *i. e.*, malaëration and fouling of water, caused by death and decay of the spawning oysters, added, in this case, to the dangers of silt deposit, have been the stumbling-blocks. The matter accordingly has rested, and no further expenses have been incurred by government in what were supposed to be fruitless experiments. The dredging contract, moreover, held by a single firm, has been unfavorable to competitive culturists. No foreshore has (until recently) been conceded by government, enabling experiments to be generally attempted or allowing shore basins to be formed as winter quarters for the oysters. Without concessions, case culture could not be attempted, and the introduction of seed oysters from Holland or Brittany has been forbidden on the ground that by this means oyster enemies might be introduced.

All attempts at introducing oysters in the Baltic have been unsuccessful. The brackishness of its water, said to become especially marked during the early spring, is certainly fatal to the European species. The density in the harbor of Kiel (June 29, 1892) averaged 1.0125 at 62° F., and at Cappeln to the northward did not become greater (high tide July 4) than 1.012 (62° F.). A greater degree of salinity at any time, even in this lower region of the Baltic, is hardly to be expected, as the fall of tide rarely exceeds 4 or 5 feet.

The canal, which is now in process of construction, and will allow the water from the North Sea to pass into the harbor of Kiel, may, it is said, have a local effect upon the marine life of the harbor, but can not from its size exert an important effect commercially upon oyster-culture. The change brought about in a similar way at Lijmfjord, in Denmark has, it is true, been an important one, but it should be remembered that the position of this locality is nearer the mouth of the Baltic, where the degree of salinity is naturally higher. Some interesting experiments have been made by the brothers Feddersen, of Schleswig, in introducing American oysters into the Baltic, hoping that this species might be readily acclimatized in fresher water. The account of this trial is recorded in *Prometheus*, No. 116, 1891. Analyses were made of water samples from the Delaware, in the neighborhood of the beds from which the American oysters were to be taken, and these were compared with similar analyses of Baltic water. The average degree of saltness in both localities was not unlike, although at high tide the Delaware water was considerably the more dense (sp. gr. about 1.018). The Feddersens caused forty barrels of oysters to be imported, were obliged to pay duty upon them as marketable oysters, and obtaining permission of the government planted them upon a submerged platform at a point in the Baltic not far from the entrance of the Schleswig River. The experiments were unsuccessful. The oysters have now been in the Baltic a number of years, and are still living, but their condition is of the poorest; they are thin, watery, shrunken, and have not grown since their introduction.

The Feddersens, in spite of these discouraging results, are resolved to attempt the introduction of the American oyster on the coast of the North Sea. To this end they have finally succeeded in obtaining from the government a provisional concession located near the mouth of the Elbe. This is the only concession that has yet been granted allowing foreign oysters to be planted, and is to be revoked if the imported oysters do not reproduce. The question of importing seed oysters free of duty, and the matter of concessions for their *élevage* is now, the writer has learned, in process of consideration.

The following is an abstract of a lease of oyster-cultural property granted recently by the German administration.

The locality is first described and the term of the holding (thirty-five years) stated. The lessees engage to carry on all negotiations openly and fairly, to be in every way responsible for losses caused by nature or war, to hold the property during the entire stated term, and to appoint and pay expenses of guardians. The administration places the control of the concession under the supervision of the professor of zoölogy at Kiel; he may determine yearly the percentage of the spawning oysters, may regulate the times of dredging and the character of the dredge; he may at all times have permission to make examinations and experiments, and for material thus used no compensation is to be given. The closed season is prescribed; the time of fishing, of which notice should be given, is to be recorded by a foreman, whose books, kept under oath, are at all times accessible. A tabular yearly report is required. Damages by storm are to be reported. Fishing boats must be specially licensed. There can be formed no embankments for oyster parks which might be in the way of passing vessels. Oysters when dredged are to be brought to a stated place for the inspection of the government officials who must be sought for within three hours after the arrival of the cargo. The lessees are then to pay revenue fees for examination in addition to the regular duty on the dredged oysters. Three hundred tons of oysters (ton=700 to 800 oysters) must (in this lease) be sent annually to market, and upon each ton 50 marks (about $12) must be paid as a governmental tax. Above this total production, if dredging is allowed, the original tax per ton is increased by the amount of 10 marks during the first seventeen years and 20 during the concluding eighteen years of lease. In payment four weeks' grace is allowed; thereafter a fine of 10 marks is imposed from the first week and 30 for the succeeding one. Taxes may be imposed as upon real property. Security must be deposited by lessees (in the present lease to the extent of 15,000 marks) in government securities, whose coupons can not be separated during time of deposit. In case of loss or theft of securities no compensation may be obtained. Legal transfer of deposited securities can only be made by governmental consent. Heirs who inherit a concession are required to renew the securities. In case the lessees fail in their responsibilities, the lease with the government becomes broken and is revoked. Improvements to property may, at option of government, be taken at its own valuation; encumbrances are at expiration of term to be removed at the expense of the lessees.

OYSTER CULTURE IN HOLLAND.

The Dutch have come to be looked upon in Europe generally as the most successful administrators of the oyster industry. A potent, not unnaturally a selfish, reason for this, no doubt, has been the direct importance of their fisheries. In the case of oyster-culture an industry has been fostered which not only gives employment to its poorer coast population, but pays into the national treasury, in rental of state lands hitherto absolutely profitless, an annual income of nearly a half million of dollars, a sum not inconsiderable to so small and thrifty a country as Holland. In view of the keen competition for leaseholds of cultural lands, and in consideration of the necessarily limited area devoted to culture, in all not as great by half as that of Long Island Sound, these facts seem to demonstrate that the management, both on the side of the government and of the culturists, has been a prudent and energetic one. The processes, both administrative and cultural, have in specialization become somewhat different from those of France, consequent in the main upon changes in local conditions. They are, therefore, interesting to study, especially as almost every modification has been evolved democratically, of the people and for the people.

The history of the government's policy in the administration of the industry may be briefly outlined as follows: The natural banks had been overdredged, practically destroyed, the usual fate of the European oyster banks, those of Germany alone excepted. This state of affairs, it must be noted, came to pass, although dredging had been rigidly confined to no more than five months of the year (October to February). The banks of the Zuyder Zee were destroyed and the overdredging in the richest natural grounds, those in the estuary of the Schelde, had rendered them well-nigh profitless. Interest on the side of government appears first to have been aroused by a petition coming from energetic culturists, who desired that lands should be conceded to them and that a thorough study be made of the life history of the oyster. A number of these gentlemen had independently visited the regions of French production and understood clearly the value of artificial culture in their own localities. In 1870 the course of the administration was determined, and has since been followed with but slight modifications. Its underlying principle, an heretical doctrine it doubtless seemed at that day, especially as even the French had not gone so far in the matter of innovations, was to do away with public dredging entirely, to survey off the natural oyster-grounds and their surrounding waters, and to lease these tracts at prices to be determined by open competition. This course was at first strongly and bitterly opposed by the fishermen, who (as in New York, Connecticut, or North Carolina), not knowing the benefits which might arise, feared the direct loss of what they regarded as a patrimony, and who, as a major reason, were not anxious to pay for what had formerly been almost free. The survey was finally completed, the east arm of the Schelde, the region most favored, being marked off in shore and deep areas, each of about 12 acres, by lines more or less perpendicular to the direction of the stream. These were then put up at auction and leased.

No restriction was imposed. The rental of the property was to be paid yearly, and in 1877 the beginning was made of a fifteen years' lease, with the option of giving up the lease at stated times. The second re-rental of the property, however, was arranged to take place several years before the expiration of the lease, and was to allow a term of thirty years, with option of giving it up every five years.* The present experience in the renting of the returned parcels, as explained to the writer by Mr. C. J. Bottemanne, inspector general of the Holland fisheries, indicates that a shorter term of lease will in the main prove more satisfactory to the government as well as to the tenant, the government getting a fairer proportional rental, the tenants being more apt to have a better opportunity of obtaining favorable concessions. A yearly lease of all state cultural property is now to be inaugurated, with a right to have this twice renewed.†

The actual oyster-grounds of Holland may be grouped as those of the Zuyder Zee and those of the Schelde estuary. The former, in spite of all efforts at their regeneration, have remained profitless, and the lack of success in these measures is attributed partly to unfavorable conditions of a northern locality and partly to variation in water densities.‡

The Zeeland grounds, those of the Schelde estuary, became from the first the seat of the oyster industry. In the east arm of the Schelde the most favorable conditions exist for growth and production; and here, in fact, is the only point in Holland where the artificial collecting of seed oysters has been profitably carried on. This region has proved a favorable one in the firm unshifting character of foreshore and even of deeper areas, and in the degree of salinity of its waters. The densities, it may be noted, varied between Goes and Bergen-op-Zoom at different tides (July 16 to 20, 1892) between 1.023 and 1.015 (62° to 66° F.), conditions that appear to correspond very closely to those of regions of production in France (Auray or Arcachon), although in the latter instances the water temperature at a corresponding season the year before was warmer by 5° to 10° F.

It is in the East Schelde that the biological problems connected with the oyster have been studied—from the time, in fact (1870), when a critical investigation of these matters became necessary. To carry on observations as near as possible to the seat of the oysters spawning, the Dutch Zoölogical Society made use of a portable laboratory, and under the auspices of this society were prepared the classic memoirs of Hoek, Hubrecht, and Horst.§ The embryology of the European oyster was here given its most careful study. Experiments were made upon the collecting of seed oysters in small closed ponds in which the water was aërated artificially, and the questions relating to the spawning of oysters in captivity were investigated, since in all experiments the impracticability of fertilizing the eggs of the European oyster proved a very serious difficulty.

Certain problems connected with the East Schelde seemed also especially to require solution, such as those of the movement, duration, and distribution of oyster fry. There remained also to determine the location of the oyster supplies whose spawning products insured the general productivity of the region. That these supplies existed was undoubted, since, on account of irregularity in spawning, the supply of cultivated oysters could not be regarded as adequate to furnish the myriads of spat which made production in the East Schelde profitable.

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* Hubrecht, Int. Fisheries Exhibit (London), pamphlet, Oyster Culture in Holland, 1883.

† See pp. 387 and 388.

‡ Dr. Hoek in conversation with the writer, at the Helder, July 28, 1892, commenting upon the failure of recent experiments in the Zuyder Zee.

§ Rapport van [illegible] Leiden, Brill, 1883–84.

It was at first thought that large natural beds existed seaward, but systematic dredgings carried on by a government steamer proved conclusively what the fishermen had always claimed, that natural beds did not occur in that direction. Unexpectedly, however, it was afterwards found that extensive banks of oysters were safely sheltered at the foot of the dikes, and these had been the undoubted source of fertility of the East Schelde. There had long been a law which, with a view to protect the stone defenses at the foot of the dikes, had forbidden the use of dredging implements of any description within 500 meters from the coast. There had thus inadvertently been allowed to remain, as a fringe circling the Schelde, a strip of natural undisturbed oyster-bearing land, to serve most conveniently in place of extensive and localized natural banks. The conditions of these fringing banks have since been clearly determined, and, from examinations made by a diver, charts have been prepared showing the size and position of these unsuspected sources of oysters. The Dutch system of protecting the natural banks will accordingly be seen to differ very little in its end from that of France, where, in general, governmental grounds are only exceptionally to be dredged upon, and where the rigid preservation of natural undisturbed oyster banks is regarded as the most fruitful aid to the oyster industry.

The management of a cultural establishment in the East Schelde can, after these preliminaries, be better understood. As a practical consideration it may, however, be noted that each lessee of oyster property has found it to his advantage to secure plots at different points scattered throughout the Schelde Basin. By this means he has found that all branches of his industry may be carried on at a minimum cost. He may, for example, collect his seed oysters on tiles at one favorable point of the basin, where he can not, either on account of interfering with navigation or of danger from cold and storms, allow them to remain during the winter. He must then transfer them to another plot which, from depth of water and favorable conditions of bottom, insures their safety during cold weather. He must also have a series of inclosures (parks) in shallow water, where conditions for growth and fattening may be more advantageously given. It may be convenient, in discussing the processes of Dutch oyster-culture, to consider them as: (1) those of production, *i. e.*, collecting seed oysters; (2) those of deep-water culture; (3) those of culture in inclosures. It will be remembered that in French oyster-culture, production and *élevage* in inclosures were alone included, and that it was exceptional from the natural character of localities that an *éleveur* might at the same time collect his seed oyster. In the East Schelde all branches of the industry come naturally in the province of the culturist, because, practiced in the same locality, each culturist would have as good an opportunity to excel in each branch as any of his immediate neighbors.

OYSTER CULTURE.

To obtain seed oysters is the most important as well as the most troublesome task of the Dutch culturist. He must first lease a favorable plot in the outer and deeper portion of the East Schelde, a rather difficult and hazardous task at the best. A locality which this year may have been very favorable, may the next year diminish in value, and a third year be worthless. A plot let in 1870 for 40 cents brought at auction in [illegible] over $1,000, while on the other hand a plot which in 1877 sold for $300 brought two years later less than one-thirtieth of that price. These extreme cases indicate clearly the direct influence of slight changes of current on the disposition of the oyster fry. It is admitted that the best localities for collecting are those where a strong incoming current is broken into eddies by opposing currents deflected by banks or headlands. At such a point a saucer-like depression of the bottom is regarded as the veritable gold mine of its proprietor; here the tiles appear to be kept clean by the circling current and are usually found crusted with the depositing spat. After a suitable ground has been obtained the second task of the culturist is to prepare his collectors. For this purpose, following the lead of the French culturist, he has found no better device than the roofing tile.

The Dutch tile is stout, square, and heavy, mounted with pegs, so that when put on edge side by side (see Pl. LXXX, Fig. 1) the faces do not come in contact. These are usually purchased from Belgium, and cost when delivered in the Schelde about $4.25 a thousand.* The length of time for which a tile is serviceable, *i. e.*, before becoming brittle and broken, is about eight years. The process of coating the tile with chalk (chaulage), to render the young oyster readily detachable, is usually performed by contract on the property of the culturist, the liming mixture differing little in ingredients from the formula in use at Arcachon, *i. e.*, three parts sand, one part quicklime, mixed with sea water until creamlike in consistency. After the tiles have been dipped in this lime bath and arranged in banks to become dry, the entire margins of the Schelde may be seen outlined, as it with massive snow banks, which shortly melt away as cargo after cargo is carried off to the collecting grounds (Pl. LXXIX, Fig. 1). About 10,000,000 tiles are sent out from the neighborhood of Bergen-op-Zoom for distribution on the lower parts of the river.

The process of transferring the tiles to the grounds is as follows: A small railroad conveys the loaded hand cars (Pl. LXXIX, Fig. 2) to the fishing vessels engaged by contract for the needs of the season ($10 per week with two men). The vessels when laden proceed seaward to their grounds at high tide, the cargo is hastily cast overboard, and the boat returns; meanwhile, as the tide descends, women proceed to the grounds from the shore and hastily arrange the tiles side by side in fringing rows (Pl. LXXX, Fig. 1).† These processes continue for about two weeks during the middle

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[illegible] together by means of a galvanized wire [illegible] collectors for collecting in the [illegible]

† [illegible] at the marginal tide [illegible]

of July. The tiles are arranged, as represented in the figure, in a single tier, quite different from the method pursued in the muddy waters of Auray or even Arcachon. The bottom is firm and unshifting, there is little danger of silt deposit, and accordingly it would be in a measure needless to raise the tiles in cases or camions. It is claimed on the other hand that, even if more oysters be obtained by arranging the tiles in layers one above the other, the upper oysters are apt to be lost on account of lack of moisture, the tiles over the ground appearing to absorb and retain moisture more favorably.

During the summer tiles are constantly shifted, sometimes changed in position, at first perhaps as often as once a week, in order that the silt-covered portions may be swept clean by the rising tide, and that the enemies of the oyster (crabs, and especially starfish) may be removed. A constant corps of attendants, mainly women, is therefore to be employed, whose wages add not a little to the cost of production. Shifting of tiles becomes less necessary as fall approaches. As the next process the tiles are to be taken into winter quarters to avoid the danger of "frosting" the young oysters while in the shallows, a danger which appears to be more feared than that of actual water freezing. A term of the contract also prescribes that the tiles be entirely removed from the river basin by December 2, a regulation aiming to prevent damage to sailing craft. The transferral of tiles is effected as before. They now return to the dikes spotted here and there with incrusting oysters. As many as forty to a tile is regarded as an exceptionally favorable set, a number so small that it is a matter of wonder to the Arcachon culturists that production in Zeeland can be profitable.

In the winter the tiles are arranged in inclosures (parks) at the foot of the dikes (Pl. LXXXI, Fig. 1), where a water depth of about a meter may be retained to guard against the danger of freezing. These inclosures may be in high or low ground, may run lengthwise (Pl. LXXXI, Fig. 2) or crosswise of the dike, and in many instances have been constructed within the dikes in polder land (Pls. LXXXII and LXXXIII).* The plan in general, like that of Marennes or the French culturists generally, seems to favor collections of small basins rather than large separate ponds, on account of convenience in cleaning and emptying. It is seldom that the young oysters are detached from the tiles during the fall, a practice usual throughout southern France. The young oysters in Zeeland are said to be much smaller than those of equal age in France, and perhaps on this account are able to sustain cold better when attached. The process of separation, or *détroquage*, begins with the end of winter. The scaling of the young oysters from the tile is, however, far more carefully performed in Zeeland than in France. The set is so scanty that every oyster must be saved and therefore the shoving thrusts of the flat knife blade of the Arcachon *parquer* must be replaced by a circling cut outlining the oyster on the limy crust of the tile. A second turn of the knife now separates the oyster neatly. It seems to be an object with the culturist to have his *détroquage* performed as early as possible in the spring, so that the oyster may not acquire an undesirable flatness and concavity of shell that long attachment to tile is sure to give.

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* H. Ochtmann, of Goes, has in the central pond (figured in Pl. LXXX) storage capacity for 1,000,000 oysters. Sp. gr. of these ponds slightly less than that of the Schelde (1021.50, 62° F.).

ÉLEVAGE.

The young oysters, as they are separated, are at once removed to ponds outside or inside of the dikes. Sometimes, if the bottom is suitably hard, they are scattered broadcast over foreshore areas. Sometimes they are for a month or more arranged in two-trayed cases of wire gauze (Pl. LXXXII, Fig. 1)* in cement and brick tidal inclosures until the thin shells have become hard enough to permit transfer to the oyster-grounds.† Although the oysters may be and are grown within the inclosures, each culturist has usually plats of ground located at favorable points in the Schelde basin, where a hard bottom, continual current, and suitable water depth permit planting to be carried on exactly as in the Long Island waters of New York State. In these localities the proprietor dredges his oysters, often shells his land during the spawning season in a way quite American, and sometimes secures in this way a quantity of spat.‡

The value of shelling as a collecting method is, however, regarded as secondary, the improvement of the ground being of the first importance. The shells are found to become rapidly silt-covered and unsuited as collectors. Some proprietors (as Mr. Ochtmann, at Goes) have such extensive plantations of this character that dredging by steam has been found necessary. An example of such a dredging vessel is figured. (Pl. LXXXIV, Fig. 1.) Oysters on this deep-water ground (rarely more than 12 feet) remain exactly as with us, growing rapidly, struggling with their enemies, and doubtless contributing their spawn to the general fertility of the Schelde waters.

The above outline of the cultural processes in Zeeland may be concluded with the following notes:

(1) In regard to expensive character of production: The industry is alone rendered possible by the price attained by Dutch oysters throughout central Europe, especially central Germany, where every town has an agency of a well-known culturist who supplies oysters from the Schelde or Ostend (*i. e.*, English ? oysters). One of the most influential culturists, Baron Groeninx van Zoelan, to whose kindness the writer is greatly indebted, has stated that during the processes of collecting each tile is handled no less than twenty-one times. The total annual expense per tile (including breakage, *chaulage*, transportation, shifting, reloading, *détroquage*, arrangement, etc.) amounts, however, to not more than 4½ cents. Second-year oysters are said to have little market in Holland. The total cost to the culturist of a three to four year old oyster can not, the writer estimates, be much less than 3 cents, *i. e.*, including packing and transportation to railroad station.

So great an amount of capital must be invested in a cultural establishment that the industry has naturally fallen into the hands of companies or of wealthy and energetic proprietors, among whom nothing but keen competition, especially as to the acquisition of leaseholds, has prevented monopoly. It appears to be evident to the authorities, however, that cultivation carried on generally on a small scale would not be as productive either to proprietor, employé, or state as the present system. Competition in price with foreign oysters is, it is claimed, the safety valve of the Dutch system of oyster-culture. It is instructive, however, to find that foreign seed oysters can not be imported into the East Schelde (although they may be in immediately neighboring waters). The reason is a commercial one, albeit the culturists maintain that they are struggling to prevent the importation of oyster enemies. The outcome of the discussion during the past year between Prof. Hoek and Mr. van Nisse* will, it is expected, be the importation of French seed oysters, whose cheapness can not fail to have an effect in decreasing local production, extending *élevage*, and reducing the market price of the Zeeland oyster.

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* The use of these cases is not popular in Zeeland. Their cost is great, and the more rapid growth that they foster is, it is claimed, not sufficient to make their use profitable in a locality so little disturbed by sediment deposits or invasions of enemies as the Schelde.

† The young oysters are often passed through sieves and separated roughly into their grades, which are then usually to be planted in different localities.

‡ H. Ochtmann, of Goes, one of the largest culturists of the East Schelde, is greatly interested in the question of the productivity of a well-shelled bottom. During the present season he has prepared more than 20 hectares in this way, but at the time of the writer's visit the result, though still doubtful, was decidedly favorable to the tile system.

(2) As to the leasing of state oyster lands and oyster legislation: Holland has no laws governing the oyster industry; that is, in the sense of general laws. Thus, for example, there is no season when oysters must not be dredged or marketed. This no doubt is the consequence of leasing out the oyster land and of the absence of public grounds from which the oysters may be dredged. The oyster laws thus disappearing, their purpose is, however, retained, but in a more personal manner. The state becomes a landlord, whose lease is law to the tenant. The board of fisheries determine what each lease shall be, its duration and conditions, and sell it by auction to the highest bidder, claiming thereby to adjust with greater nicety the requirements of state regulation to natural local conditions. A law suited for one cultural locality, it is claimed, is severe for another; even a part of a locality is not to be governed by the restrictions applicable to cultural needs in shallower or deeper water. The terms of leasehold are studied, as may well be done in so small a district, by the inspector of fisheries, whose report suggests needful changes or alterations. Land hired for oyster-culture, it is argued, is like that hired for farming. If a person secures a good lease, and is deriving a good profit from it, he must be willing to bid in its leasehold, but at the same time his neighbors have an equal right to compete for it. Thus it is best for both tenants and landlord, the state as the landlord deriving, no doubt, an immediate benefit from this course of policy.

All lands suitable for oyster-culture may be leased, their value naturally depending on their situation, suitability for collecting and for *élevage*, the length of time under water, and the character of bottom. In favored localities the tracts grow smaller as competition for their leasehold increases. Polders (waste land behind dikes) may be converted into oyster parks and become profitable to the state as well as to individuals when rented under the same conditions as the outside property. The lease between landlord and tenant represents the code of the oyster industry.

Each year the sale of parcels of land is advertised. A catalogue prepared by the inspector of fisheries, Mr. C. J. Bottemanne, announces the plots to be leased, the terms of the contracts, and the time and place of the sale. The conditions under which the present leasehold is given may thus be briefly stated, translated from the Voorwaärden van Verpachting van Vischplaatsen Schelpdieren-Visscherijen en Weervisscherijen, Ooster-Schelde (Tholen, 1891). The auction takes place in a notary's office in Bergen op Zoom between 11 and 1 o'clock, seventy parcels to be sold each day. The sale of lease is to be to the highest bidder. Should no bid be received for a stated plot it is passed to the next plot to be put up. There only are eligible as leaseholders who are natives of the Netherlands, who are not indebted to the state, and who can furnish two responsible bondsmen. In case of doubt in regard to bids the plot is to be at once put up and resold. A deposit of 5 per cent of the yearly rental must be made at the office of the secretary of the board of fisheries within eight days from date of sale, and a formal written lease of the parcels may there be obtained at a stated fee for copying. Yearly rental for oyster plots must be paid by the 1st of March. In inaccuracies in surveying the government—i. e., board of fisheries—is not to be held responsible. The lessee, however, must know his boundaries. He has no right to make use of land that exists or may exist between boundary lines. No redress is to be obtained for damages to leased property* occasioned by navigation or on account of natural causes, direct or indirect, consequent upon changes made in governmental drainage of land. Property can not be divided or subleased without written consent of the board of fisheries. Lessees are responsible for damages to their neighbors as well as to the state, but the state does not become responsible for the damages of a lessee. The numbering of the boundary stakes is intrusted to tenants, with a fine of 25 florins ($11) in case of neglect; when deranged on account of storms they must be promptly replaced. In the meanwhile, however, trespass is punishable by a fine of 50 florins. Culturists whose territories do not touch the bank have at low tide the right of way between their neighbors' grounds. The shortest way to such ground is alone permitted under penalty of trespass, and in this regard, as in all others, the lessee becomes responsible for the doings of his employés. The culture of mussels is forbidden on property rented for the culture of oysters, punishable by a fine of 100 florins. The mussels, if not at once removed by the lessee, may be removed by state authority at the expense of the offender. Foreign oysters are not to be introduced (in the East Schelde only). Those, however, dredged north of a line drawn between Dover and Dunkirk may be planted, if with stated consent of the board of fisheries. Dredging at night (one hour after sunset to one hour before sunrise) is punishable with a fine of 100 florins. Dredging vessels shall be numbered at the bow and on the sail in characters of a stated size. Water courses must not be interfered with. Any obstructions of this character must be removed within twenty-four hours after notification by the board of fisheries, or shall be removed by the state at the cost of the lessee. The lessee is responsible for the amount of his lease; if his holding when sold does not furnish this amount, he is to make good the difference. All rights to oyster cultural property are to be in every way subordinate to those of the administration of dikes and waterways. Different parcels of land are to be given leases of different duration. An annual lease at option of tenant may, in stated plots, be twice renewed.

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* Verlag van den Staat der Ned. Zeevisscherijen, 1891, pp. 83, 84.

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* A regulation not here stated provides that tiles used as collectors shall not remain in the navigable waters later than December 1.

OYSTER-CULTURE IN BELGIUM.

The oysters of Ostend have long been especially esteemed for their flavor. Parks, or, more accurately, *claires*, reservoirs for oyster fattening, have been in use over a century. The location of Ostend has not favored the formation of natural banks, and the few that existed were early dredged out and destroyed. Efforts that have occasionally been made to replenish them have been fruitless in every case. Without banks no governmental restrictions have been laid upon dredging, and production can not be attempted. The Belgian coast seems in every way unsuited for planting purposes, and the river basins and open canals are so liable to mud accumulations that their use would be impracticable, no matter how favorable the character of their tidal waters might be for purposes of culture. The region, in fact, is in many regards comparable to that of Marennes. There is a low-lying country, a sluggish river, the Yvres, and a series of branching canals which freshen the tidal water and appear to be surprisingly rich in oyster-food organisms. It is not unnatural that *claire* culture should have been here introduced, and that these ponds should have been dug on either side of the main canals where the character of the tidal water had been found most favorable.

Belgian oyster-culture is accordingly to be reviewed in its single aspect, that of *conditioning*. Ostend stands as one of the most important oyster depots of Europe, derives its oysters from neighboring countries, and after a few weeks or months is enabled to distribute them as Ostend oysters to England, Germany, and France. The industry appears to have grown up naturally and quietly, almost, in fact, before the government was aware of its importance, and perhaps mainly on this account the culturists are allowed to continue their operations almost entirely without state restrictions. Concessions for cultural purposes are rarely, if ever, obtained, the lands occupied by the dozen or more establishments dotted along on both sides of the Ostend canals being, with scarcely an exception, the property of the culturists or of their individual landlords. These establishments are regarded simply as private storehouses, whose supply of water from the canals is allowed to be taken by an apparently tacit permission of the authorities.

The cultural processes of Ostend vary but little in the different establishments and are easily understood. As a convenient type, that of Messrs. Stichert & Stracke may be taken. This is courteously open to the inspection of visitors to Ostend and is admirably managed. It borders the canal at the side of the highway to Bruges, and is but a few minutes' walk from the city. A *claire* basin about a hectare in extent has been dug out (Pl. LXXXV, Fig. 1), which takes directly from and empties its waters into a main canal (Pl. LXXXIV, Fig. 2). The basin may, at high tide, admit the fresh supply to a depth of about 7 feet; its bottom is level, of compact clayey mud, with masonry, however, near the margins; and its sides, as will be seen from the figure (Pl. LXXXV, Fig. 2), are carefully turfed. This is the main or reservoir basin; it receives the turbid water of the canal, allows the sediment to be deposited, and serves, doubtless, in generating oyster food. This reservoir may readily be emptied, dried, and cleaned whenever the deposit of mud becomes inconvenient. A corner of this main pond, as represented in the figure, has been inclosed by masonry walls, and it is only this portion that is destined for the oysters. It is entirely of concrete, its waters drawn from the reservoir pond being now regarded as free of sediment and rich in food organisms. The density of the water (July 19) remained constant in the canal and ponds at 1.023 (61° F.), a uniformity of saltness which is no doubt in part dependent upon the locks which occur seaward, and the tide water is perhaps proportional in incoming volume to the brackish water entering landward.

It is certain that the conditions of water in the reservoir are extremely favorable, and that the food therein provided is sufficient to feed a half million of oysters thickly stacked, a remarkable number for an area so restricted. Processes like those of Marennes, intended to richen the supply of oyster food in the reservoir, do not appear to be employed. The water, naturally rich in suspended organisms and their food stuff, is perhaps bettered in its conditions for oyster feeding by remaining a day or two standing, and is made use of before becoming deaërated. The *claircs* of Marennes, on the other hand, renew the water but seldom (fortnightly), secure aëration by maintaining only a slight depth of water (10 inches), dry out the bottom regularly, and are even spaded up to richen the food stuff of the organisms which are to fatten and color the oysters.

The Ostend principle of frequently changing the water in the reservoir renders it unnecessary to spade up or specially arrange the *claire* bottom, and at the same time does not tend to green the fattening oysters. The low *claires* at Marennes, where the water is often renewed, produce white oysters, while the high *claires*, it will be remembered, develop the green moss, *Amphipleura* (*Navicula*) *fusiformis ostrearia* Grun., in quantity. Frequent changing of the water tends, moreover, to lower the mortality in *claire* culture.

At Ostend oysters are received continually from England, France, or Holland, and are at once placed in the concreted compartments. They are banked several tiers thick, and are often arranged in a series of parallel alleyways formed by low board partitions. Their time of arrival is registered, and a month is usually allowed them to acquire the taste and appearance of Ostend oysters. The only process to which they are subjected is that of cleaning and rearrangement. This is performed by the attendant before renewing the water supply, by shoveling them roughly to and fro in the different alleyways as the water is passing out. The roughness in this process may, from attrition, not improbably account for the smoothness of shell which forms one of the characters of the Ostend oyster. This local character, observes Leroux,* is also attained by a regular course of shaking the oysters in bags; it is suspiciously claimed by the rival culturists of Zeeland that a stamping machine is in use to break the fringing edges and favor the production of a smoothly rounded shell margin. Higher water temperature marks a slight modification in the management of the basins. Oysters that are to remain during the summer are disposed not so thickly in the cemented compartments, are more frequently shifted about, and are given fresh water from the reservoir as often as twice a day.

The importance of Ostend is understood when we consider the constant stream of oysters that passes through the dozen or more establishments during three-quarters of the year; and a calculation might, in a general way, be based upon the storage capacity of a single park, such as the one described, which is, at the greatest, about a half million oysters per month.

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*Traité pratique d' Ostréiculture, Nantes, 1881, p. 30.

The grades of oysters furnished by an Ostend firm are in order of value about as follows: (1) Native Whitstable; (2) native Colchester; (3) Burnam native "nut" oysters; (4) Victoria natives, a French oyster transplanted in the Thames estuary (these grades are said to stand two weeks' transportation and storage); (5) French oysters (from Brittany mainly), said to bear a week's storage; (6) the Dutch oyster (Zeeland), placed as the lowest grade, perhaps for commercial reasons.

In the neighborhood of Ostend the Belgium coast furnishes two more localities for oyster conditioning, one at an eastern coast suburb, Blankenberghe, the other to the westward at Nieuport. The establishment of Dr. Anselme ver Nieuwe at Blankenberghe (Pl. LXXXVI, Fig. 1), differs somewhat from those of Ostend, and should be briefly noticed. It is near the Blankenberghe sea dike, and draws its water from a canal near its outlet into the sea. This canal as it backs up its waters before they are allowed to escape, forms a kind of *claire* reservoir, slightly brackish,* where the silt is deposited before the water is drawn by the culturist into his fattening "pits" or small cemented basins. Gates lifted by a cog windlass enable the water to be taken in daily or to escape. The cemented pits are separated by masonry walls into four side-by-side compartments, each about 30 by 20 feet, and may be separately emptied or filled. In each compartment are low longitudinal partitions of boards, between which the oysters are thickly stowed, and are daily shoveled to and fro as at Ostend. A depth of about 8 feet of water is normally maintained. The oysters become in condition in about three to four weeks.

At Nieuport the establishment of Meinesz & Co. (Pl. LXXXVI, Fig. 2) presents a number of modifications of the usual Belgian processes. Cultivation proper, *i. e.*, the raising of marketable oysters from imported seed (from Brittany) is here carried on. The principle is that of Ostend, but is favored at Nieuport by making use of an old fortification whose U-shaped moat forms a large reservoir pond. The two cultural ponds lie end to end between the arms of the U. It will thus be seen that the water, which may be admitted from the canal emptying into the harbor, may first be passed into the end of the reservoir pond, and in escaping may be made to form the circuit flowing out through the cultural ponds at its original point of entrance. The reservoir ponds, although shallow, appear to contain several times the water volume of the cultural pond. The water density of the latter slightly freshened from the canal and harbor, perhaps also by surface drainage, was at the time of the writer's visit 1.021 to 1.022, at 59° F. As at Ostend, the reservoir is daily filled and at low tide on the following day, when the water has become nearly siltless and richer perhaps in food organisms, the contents of the reservoir will be allowed to flow into the cultural ponds.

All ponds appear to be channeled along the median diameter (where sediment accumulations may be readily removed), and a normal water depth here of about 6 feet decreases gradually to the margins. The reservoir ponds are earth-bottomed; the cultural ponds are mainly of concrete. The richness of the organism element of the reservoir water is, as at Ostend, attested by the remarkable numbers of oysters which are here cultivated. Each cultural pond measures 20 by 200 yards, and, as the illustration shows, is filled with wire-gauze cases (3 feet 6 inches by 3 feet 6 inches by 2 feet 6 inches), in transverse rows of sixteen. Each case contains no less than three or four trays of 300 to 400 oysters each. The cultural processes appear to be simple, consisting merely in rinsing sediment from the trays and allowing the muddy water then to be flooded out. The loss of young oysters during the first year is said to be considerable, amounting to almost 25 per cent, a mortality for which no doubt the settling of a heavy sediment is partly responsible.

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*Water in the pits was 1.022 at 60° F., July 29, 1892.

Belgium, in summary, represents the oyster industry in but little more than a single stage—that of *conditioning* or fattening. Production is not attempted, there are no natural oyster banks, and the sediment-bearing character of the water would, it seems probable, be greatly adverse to this branch of culture. The natural richness of the feeding conditions of the Ostend waters is due, it appears to the writer, to a favorable density of the water (about 1.022 to 1.023), together with the remarkable richness of the incurrent canal water in the food stuff upon which the oyster food organisms multiply rapidly. This, attested by the remarkable number of oysters that are quickly conditioned in a given water volume, has (1) allowed Ostend to become a depot and center of supply of almost every grade of foreign oysters, and (2) permitted the conditioning to be carried on within a small area. Private property, therefore, has come into use instead of state concessions, and brings with it rights of permanence and freedom from conditions.

Independence in the management of each establishment seems to have been under the local conditions naturally developed and very successful. The governmental action in whatever has been done, has, accordingly, aimed merely to favor, as far as possible, the making of private property valuable for culture. The new canal, projected by the authorities,* will thus directly benefit the adjoining properties and will, thereafter, from the economic side, become of state importance.

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* Bull. Mens. de l' as. com., mar., ind., et agr. d'Ostende, Apr., 1892, p. 206.

THE OYSTER INDUSTRY IN ENGLAND.

The following discussion is intended to summarize the chief features of English oyster-culture, and to show its present position from the standpoints of dredger, culturist, and government. The subject may conveniently be examined under three general headings: (1) the natural supply of oysters, (2) the granting of foreshore for purposes of culture, and (3) the cultural processes.

THE NATURAL SUPPLY OF OYSTERS.

The natural supply of oysters in Great Britain has been among the richest of Europe, and the quality as well as the quantity of the English oysters appear to have been noteworthy from the earliest times, as their merits are often recorded enthusiastically by Roman authors.*

There have been points in all of the many estuaries indenting the British islands where favorable conditions have produced natural oyster beds, which have become exhausted only within very recent years. In some localities the extreme saltness of water has not been favorable to rapid production, and these older and more slowly growing banks have been the first to succumb to overdredging.

Estuaries, on the other hand, whose entire water volume has been tempered with a steady proportion of fresh water appear to represent the oyster's natural breeding-grounds, and have retained their fertile character to a remarkable degree, even after the beds of spawning oysters have been well-nigh destroyed. Of this no better instance can be furnished than of the broad wedge-shaped indentation that forms the estuary of the Thames. This, although the most thoroughly-fished oyster-ground of England, and at the same time the nearest to the London market, has nevertheless held its reputation, even to the present day, as a natural "spatting" ground. It is noteworthy that on all sides there are in this region incurrent fresh-water streams which tend to keep the density of the entire volume of water slightly reduced. At the head of the estuary is the entrance of the Thames, whose channel passes down the axis of the wedge and separates naturally the shallow waters of Essex from those of Kent. On the south side of the channel are the Kentish flats, probably the richest and most famous of known grounds for oyster fattening. These begin at Havesham, under the lee of the isle of Sheppey, fringe the southern shore with an oyster-bearing zone of 2 or 3 miles in width, and extend seaward almost to Margate. There are here included about 30 square miles of cultural ground, upon which the depth of water at low tide varies from 1 to 2 fathoms. The bottom, as a rule, is hard, compact, clayey, and little apt to shift, and by continual processes of dredging and reshelling has been made smooth and clean. Midway between Sheppey and the sands of Margate is Whitstable, which overlooks the best portion of the Kentish flats. The water density here was (August 16, 1892) 1.025 at 64° F., and appeared to be remarkably uniform at both tides from the shore to the channel.

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* Cf. Dr. Philpots "Oysters, and all about them," Richardson, London, 1890, p. 4 *et seq.* Hoek, Rapport sur les recherches concernant l'huitre et l'ostréiculture, Brill, Leyde, 1883-84, introd.

As a fattening ground for oysters this locality is regarded as not a little dependent upon the outcrops of the Sheppey clays, as these may naturally be regarded as furnishing the pabulum for the rapid development of the minute plant organisms which become the food of the oyster.

The northern or Essex side of the Thames estuary receives a series of small incurrent rivers and is, therefore, in its shallower portions slightly fresher than the waters of Kent. Production of seed oysters appears to be most successful in and near the mouths of these rivers, where, other things being equal, the density is lower (*i. e.*, about 1.022 to 1.023).[*] This oyster region is famous at three ports—the river Crouch near Burnham, the Blackwater, and the Colne near Brightlingsea (Colchester); notes upon the cultural measures at these localities will subsequently be given.

The natural oyster-grounds have not escaped the fate of those of neighboring countries during the period of their public dredging. The region of the Thames, notwithstanding its fertility, could not endure the increasing strain upon its resources, caused by the demand of the neighboring London market. The effects appear to have been felt first at Whitstable, as the district whose oysters were most sought for, and not unnaturally caused this center to become the depot of the producing region of the Thames, draining its supplies for growing and fattening from the Colne (1866),[†] the Blackwater, and the Crouch. Here too the effect of overfishing soon became evident; the natural oyster-grounds were exhaustively dredged and the quantity of seed oysters became less and less. All British estuaries were now, one by one, laid under contribution by the increased demand, until at length their natural resources became overtaxed. The demand had then to turn to the continent for its principal supply of seed oysters, which had there come to be produced cheaply by artificial means.

As the natural beds have at all points been depleted, so have the chances of a heavy natural spat[‡] appeared to grow less and less; popularly this dearth of spat is generally attributed not more to overdredging than to the lack of favorable or "spatting" seasons (*i. e.*, warm summers with absence of storms or winds), and the exceptional years of 1858, 1859, 1866, and 1881 are looked upon as direct proofs of climatic influence. The reappearance of "spatting" years is generally looked upon as positive, although irregular in occurrence to a noteworthy degree, in general, however, to take place "three times during a lifetime." This firm belief in the natural and unfailing productiveness of the oyster-grounds has only been equaled by the dredger's steadfast view, which gives him birthright from the days of Magna Charta, to fish as often as possible upon the public oyster banks, and to resent as a personal injury all authority to reserve lands for the purpose of benefiting everybody. It may, of course, be possible that the next season, through favorable conditions, will prove a "spatting" one, although it must be admitted that the chances are decidedly adverse.

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[*] These densities correspond very closely to those of Auray and Arcachon, the regions of production in France, and are similar to those of production at Tarente (p. 359). The sp. gr. at Burnham (August 15) did not exceed 1.024 at 64° F., at Brightlingsea 1.023 to 1.025 at 65° (August 16). The writer was told by Mr. Newman of Colchester that the Colne waters during the early spring months are perceptibly freshened.

[†] Philpots' "Oysters, and all about them," London, 1892, p. 366. The price of Colchester seed is here recorded as $1.50 per "tub" (20 gallons) in 1859, and about $2 in 1885. The price at present is about $10 per bushel.

[‡] This view appears to be, with limitation, that of Prof. Huxley. Cf. Eng. Ill. Mag., Nov., 1882, article on Oysters and the Oyster Question.

When exceptionally favorable seasons can not be depended upon, the means for securing spat suggested by continental experience have been to maintain rigidly a permanent stock of natural spawning oysters. Following this course of regeneration, the spawning-grounds of Auray and Arcachon have developed surprising regularity in spatting seasons, a result which could hardly have followed had the natural supplies been exhausted and had the culturist waited for the advent of favorable years.* (Cf. p. 404.)

To obtain seed oysters in the Thames estuary by artificial processes has been aimed at by many culturists; and the high price of native seed has ever been a great incentive. All experiments, however, have proven unsuccessful. Tiles placed in continental methods on the Whitstable flats were shown to be scarcely more fruitful than a bottom of shells or gravel, a result not unaccounted for when we consider the normal absence of natural spawning beds in the neighborhood and the comparative barrenness of neighboring oysters when constantly cultivated.† The process in use in nearly all the English localities is accordingly little more than the shelling of the ground during the spring, in the manner usual in Long Island waters of the United States. As will be seen in the discussion of the industrial processes, this operation pays for itself by adding to the cultural capacity of the ground, even granting that no seed oysters are obtained. In the event of a favorable season, the shell collection is as apt to be "smothered" with spat, as would be the more costly kinds. Thrift in this matter can not, however, be regarded as British, as tile-collectors, it will be remembered, are only employed on the continent, where at particular points the annual set is sufficiently heavy to make their use profitable.

In artificial production the goal of all English culturists has been the cosmopolitan one, to rear in a reservoir pond a large percentage of the two or three millions of embryos set free by each spawning oyster. The profits of a success in such a venture, even for a season, in view of the price of native seed, would be so great that company after company has been organized for the purpose of artificial culture. Costly ponds have been prepared, varying in size from square yards to acres, with almost every condition of bottom, density of water, kinds of collectors, number of contained spawning oysters, and devices (including steam power) for water aëration. In one instance (Hayling Island) may be mentioned an ingenious device for changing the water in the breeding pond, a device which allowed the surface water to be withdrawn at night and the bottom water during bright sunlight, when the young were supposed (upon what exact evidence the writer is unable to learn) to seek the surface. The difficulties that have stood in the way of the success of these enterprises appear to have included excessive saltness of water, sediment accumulations, and malaëration caused in the main by the restricted area of the basin, which has resulted in fouling the water by the death and decomposition of the inmates of the pond. With these evils there has often been a general mismanagement financially. During the first season, in many cases, the cleanliness of the new-made ponds has given the experiments almost a phenomenal success.

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* In regard to regulation, see Huxley, *loc. cit.*, latter part of article.

† Hoek, *loc. cit*, p. 481.

Permanent successes in pond culture have never occurred, and in the present connection it would scarcely seem necessary to consider in detail the experiments carried on at various times by the establishments at Reculvers, Emsworth, North and South Hayling, Braiding, Newton, and Poole.

To be able to buy seed oysters cheaply in France has obviously been of far greater importance to the English culturist than all of his experiments at production, and as an alternative has no doubt caused this branch of the industry to be neglected. Young seeds transplanted to English waters become, after three years of growth, identical in shape and taste with English natives,* and are often sold both by culturists and dealers at the prices of the best grade of natives. The profit in such a case is so great that it becomes of great commercial advantage for unscrupulous culturists or companies to keep profoundly secret the origin of its seed oysters as well as their relations with the buying agents in France and the selling agents in London.

CONCESSIONS.

The English oyster-grounds may be roughly classed as public, private, or concessional. The public grounds include all natural beds and unoccupied portions of the foreshore. They may be worked within stated months, and as their limits and favorable points are well known to the fishermen, they are in general exhaustively dredged. Private grounds extending under water have practically the same vested rights as farming land; but their use in oyster-culture, by reason probably of expense, appears to be limited.

By far the greater part of the English cultivated grounds are held directly from Parliament by a fishery order obtained by petition through the Board of Trade. By this means a company or individuals may obtain on long lease at almost nominal rental a tract of the foreshore, but with the condition that it must be cultivated, or, on an adverse report of an inspector of fisheries, revert to the state. This stipulation has in many instances proven a very desirable one, since it has allowed the lands to become used by a second tenant if a former one was remiss in its cultivation. Culturists accordingly are subject to the criticism of their neighbors, and on their complaint to an investigation by the Board of Trade, whose inspectors determine and report whether the concession, altogether or in part, is maintaining its usefulness to the general public. This feeling in regard to taking away property from the public fisheries, sharpened by much adverse criticism when the matter of fishery orders was being discussed, has no doubt had its weight in rendering the process of obtaining a concession a long and somewhat troublesome one.

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* This was stated to the writer by one of the most influential culturists at Whitstable. The circular mark showing the original attachments of French seed to the tile becomes in many instances obliterated; its absence can not therefore be regarded as an infallible test.

It is contended, however, by the fishermen that a fishery order is so difficult to obtain that it can be utilized only by syndicates, or culturists of the wealthiest class. The first step in obtaining a concession, as stated in the act of 1868,* is to show that the property in question is unoccupied and is not held under previous grants. This process naturally becomes difficult in a locality long known to have been of cultural value, and may render it first necessary to carry through a petition which reduces the size of an unutilized neighboring grant,† a result, however, not easily attained, as the defendant is apt to be a wealthy and litigious corporation. Monopoly in the management of an oyster-ground occasionally ensues, and the land appears to accumulate in the hands of the wealthiest culturists. The famous Kentish flats of Whitstable are held by only a few corporations; the Colchester grounds by a single one.

In this regard it is interesting to contrast the Dutch system of competitive land-rental with short leases, where the state reaps the profit of the high rental and where sharp competition among many culturists tends to reduce the market price of the product.

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* The sea fisheries act (July 13, 1868) indicates the course to be pursued in obtaining a foreshore concession—one over whose area the tenant is given right to dredge, plant, and remove oysters at any and all times during an extended period (as long as sixty years), provided that its usefulness to the public is guaranteed. By instructions from the Board of Trade, applicants must "cause printed copies of the draft of the order as proposed by them" to be circulated to owners, lessees, occupiers, and neighbors of the portion of the foreshore to which their application relates. During a month thereafter the Board of Trade is to receive written objections to the grant of the petitioners. The matter then passes into the hands of an inspector of fisheries who shall weigh evidence for and against the application, and, if necessary for this purpose, may hold a sitting in a locality convenient to the property in question. His written report, for consideration of the Board of Trade, approves of, deems inadvisable, or sets conditions upon the application. The Board of Trade is now empowered to make out the fishery order, define terms and duration, costs in all matters to be defrayed by petitioners. The order is now approved by act of Parliament, if it is found in no way conflicting with the useful rights of older acts, charters, or prescriptions. A more speedy course is afforded by the law of 1877, whereby a tract of 5 acres (twenty-one years' duration) may be secured directly by consent of Her Majesty in Council. Provision is in every case made for continuing to secure the benefits to the public of these conceded lands, through annual reports of the fisheries inspectors to be laid before Parliament.

The act of 1868 provided, furthermore, for protecting the private oyster-grounds from trespass. It must be proven that the property in question was removed from the plaintiff's grounds. Staking and buoying of a concession is made obligatory, and it is provided that printed copies of a fishery order must be kept on sale in a convenient locality.

Besides the general restriction of oyster dredging during the summer months, it is provided by the law of August 10, 1877, that deep-sea oysters are forbidden to be bought or sold between the 15th of June and the 4th of August, unless for purposes of cultivation. The Board of Trade is empowered to reserve banks for the period of a year, with right of yearly extension, for purposes of regeneration. The restriction of the general sale of oysters (act of 1877) during the summer (May 14 to August 4) appears to have been commonly disregarded to the detriment of all spawning regions. Firm action, however, in this matter was undertaken during the summer of 1892, by the Fishmongers' Company. A number of prosecutions as test cases were instituted and convictions were secured. With this precedent the company, it is hoped, will be enabled during the coming summer to entirely close the sale of oysters and establish a season of much needed tranquillity on the spawning-grounds.

† Anson and Willett, prize essay of the International Fisheries' Exhibition, Clowes, London, 1884, p. 102–111.

CULTURAL PROCESSES.

Perhaps there would be no better way of understanding the character of the English oyster industry, both in its management and in its processes, than by examining briefly a typical oyster company, as for example that of Whitstable. The Whitstable Company is an oyster syndicate of the most powerful type, exceptional in its antiquity and in its closely coöperative character. It grew up about a century ago, and in 1793 secured by royal charter about 3 miles of the best oyster-fattening grounds of the Kentish flats. Its organization is an interesting one; its membership is hereditary, and was formerly the birthright of every son of a "freeman" of the company. The number of members, however, became finally so great* that for convenience as well as for economy in management, a restriction was made admitting to the company only the eldest sons of freemen. Every member has a voice in all matters of management. A small evening parliament is held monthly in the assembly room of the building overlooking the Whitstable grounds (Pl. LXXXVIII, Fig. 1), and all matters of management, including buying and selling, are here very generally discussed. The members constitute a clan, with two or three family names predominating, which has come to regard outsiders with commercial suspicion, and has long been extremely reticent in regard to the ways and means of management. Each member of the company is entitled to a mutual dividend of profits, and to be employed with stated wages as often as his turn may come. The "stints" in the necessary cultural operations of the grounds are known and assigned to members beforehand, and "a bell is carried round and rung every morning to rouse the dredgers whose turn it is for duty."† An idea may be obtained of the extent of the Whitstable Company when we consider its small army of employés, its fleet of sixty dredging boats (Pl. LXXXVII, Fig. 1), and its invested capital in cultivated oysters valued at $1,000,000. The annual sales of the company are estimated at from $800,000 to $1,000,000.

In an industry like that of the Whitstable Company it is quite evident that the amount of natural set upon the cultivated grounds must be an almost inappreciable portion of the seed oysters that are there cultivated. It is said, in fact, that all of the seed that can annually be purchased on the 30 square miles of Kentish flats, or in all other natural oyster-producing regions of Britain, could together form but a small item in the annual purchases of the company. So favorable, though, are the conditions for growing and fattening oysters at Whitstable that the exact origin of seed oysters seems a matter of minor importance; at the end of three years the seed purchased economically from Auray has become in every appreciable regard an "English native."

The processes of growing and fattening oysters are not widely different from those of Connecticut; the methods of culture employed by the French or Dutch have certainly not been followed.

Seed oysters ("brood" oysters) are usually purchased in the early spring, when they are taken to a portion of the grounds where not more than a fathom of water is retained at low tide, and are strewn thickly over the bottom. There seems to be no danger at Whitstable of planting too thickly, there being apparently no dearth of food organisms, and the dredgers believe that "oysters fish (fatten) better when they are thick laid." Dangers from mud or sand do not occur. The bottom is smooth and hard, as it has been for ages regularly shelled, dredged over, and cleaned. There are many men and boats employed by the Whitstable Company, and it is usually arranged so that the detachment of dredgers shall spend half the week in "catching" the oysters for market and the remaining half in "cultivating" the grounds. Cultivation consists in dredging over the grounds with a view to dislodging weeds and sediment, to keeping the ground clear and level, and to capturing the oyster enemies. The reshelling of ground is usually practiced during the early spring. Apparently no attempts are made, as on the continent, to increase the extent of cultivable lands by inclosing, as might easily be done, small areas near the line of low water. As seen on Pl. LXXXVII, Fig. 1, a large portion of the shore line is exposed, which in France or Holland would be far too great in value to lie fallow.

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* In 1876 there were 400 members.

† See Philpots', *loc. cit.*, p. 364, for a very interesting discussion of the Whitstable fishery.

It is obvious that case culture (p. 386) would be expensive and meaningless in a region like that of Whitstable, where danger from mud or sand, or even enemies, appears to be at a minimum. The only device for this kind of culture which might perhaps be practical would be to extend wire gauze a few inches from the bottom to permit an additional tier of oysters to be reared. During a second or third season the only additional process is the transfer of oysters into deeper water—*i. e.*, 2 fathoms—there to remain until they have become of marketable size. The larger oysters appear to be less endangered by sediment deposits and thrive even where the ground is soft enough to allow the weight of the oyster to sink it below the surface of the mud. The dredgers firmly believe that under these conditions the oyster has to some extent the power of gradually regaining the surface, and cite as proof of this fact that oysters in a given place may be dredged in greater quantity after several days of rest have been given them. This power on the part of the oyster has been questioned by several zoölogists, but the writer regards the proof furnished by the parks of Cancale and the Marennes as sufficiently affirmative to place the matter beyond question. Oysters dredged for market are finally brought to the warehouse of the company, and while awaiting shipment are classified, placed in loose baskets of netting in concreted tanks or "pits" (seen in Pl. LXXXVIII, Fig. 2) fed by tidal water.* These pits are often located for shelter in the warehouse, forming, in fact, a kind of masoned cellar, whose compartments of about 20 feet square may be refilled at high tide and retain 8 or 10 feet of water. By this method of storage a large number of oysters may be kept in safety for immediate demands, and serve as a reserve supply in case stormy weather prevents dredging. Pits of this character are not regarded as of value at Whitstable, either for fattening or *dégorgement*.†

Oyster-culture in England generally varies but little in methods from that of Whitstable; other localities, therefore, need be but little commented upon. At Faversham, westward, and at Herne Bay, eastward of Whitstable, sediment deposit and invasions of mud, and at the latter place shiftings of sand also, have been of considerable annoyance. The remedy has been continual dredging of the grounds together with judicious shelling or macadamizing of the bottom at certain points. Weeds have been carefully dredged out as a means of keeping the ground clear and allowing the tides to wash off the depositing sediment. In regions where spat is expected to occur with some regularity, the greatest care is taken, by reshelling and clearing the bottom, to assure the greatest chance of a successful set. This character of bottom is often secured in the rivers Blackwater, Crouch, and Colne (below Colchester) by a regular process of harrowing the bottom during the beginning of the spring. By this means the loose sediment accumulating during the winter is broken up and carried off by the tide. For this operation a harrow is prepared whose teeth, 2 or 3 inches in length, are of iron, bent slightly forward at the tips. When in use it is carefully arranged so that the teeth may not break through the crust which was formed by the shelling processes of former years; this is prevented by adjusting the length of the harrow rope from the dredging vessel, and the behavior of the harrow, like that of a dredge, is readily determined by the "feeling" of the rope.

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* In the pits of the Whitstable Companies' warehouse the water (August 13) at 68° F. was of sp. gr. 1.0245. The temperature was here higher by 5° than the tidal water immediately without.

† U. S. F. C. Bull., 1890, p. 380.

Along these rivers tidal pits dug out mainly in open ground are very frequently employed. Their use is principally for storage during the winter and early spring, as it is said that serious losses are then caused by the freshening of the rivers at low tide, "when the oysters are so weakened that they become particularly sensitive to frosting."* In regions where the water is considerably salter, as at Falmouth (60° F., 1.0265, August 10), pits are not generally employed. In some instances they are used for providing temporary shelter.

A brief notice may be given of the commoner varieties of oysters of the English market. The highest grade is the "Native," Whitstable, Faversham, Brightlingsea (Colchester), a small oyster measuring 2¾ by 2½ inches, with a smooth, thin, pearly shell, having a firm, smooth margin, valve outline stoutly crescentic, animal well "fished" (fattened), white; retail price about 4*d.* apiece. The Burnham native, "Button oyster," or "Tom Thumb" is highly esteemed; it is remarkably small, stout, and heavy, and appears to be of extremely slow growth; individuals at least 15 years old have been noted. The majority marketed are of undoubted French origin, having been for a longer or shorter time laid down in English waters. These are comparatively low in price, and are known under various trade names—Royal, Victoria, Seconds, Arcachons, Aurays—usually to be recognized by their shape and by the circular mark upon the shell, often with adherent cement, showing where the seed oyster was formerly attached to a collector. This, too, is one of the marks of the small oysters from Ostend. Large, rough-shelled North Sea oysters are not uncommon. The cheapest grades are the American and Portuguese. Of the former, those that the writer has seen appear to have been of southern origin, similar to those largely planted in the waters of Long Island Sound; when laid down in English waters they grow rapidly and become exceedingly "well fished"; their color, however, appears to change from white to leaden gray, and the taste becomes metallic, resembling that of the Portuguese oyster. The American species does not appear to spawn in the English waters, although some specimens examined by the writer at Whitstable were with well-developed ovaries and appeared to be almost in spawning condition. The price of the best relaid American oysters is about 40 shillings per 1,000. Portuguese oysters retail at about half of this price. They grow very rapidly, an instance of a growth of 4 inches in two years being recorded. Their spawning in the Medway, at Sharfleet, has been observed.†

The oyster industry in England, it will be seen, is established on a different footing from that on the Continent. It has developed characteristic features, owing, in a large measure, to the difficulty with which any fishery rights may be taken from the people. Not that there has been a lack of interest on the part of people or

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* This was stated by Mr. Newman, Colchester, August 16, 1892.

† Philpots, *loc. cit.*, p. 355.

Parliament in the practical question of regenerating the industry and of fostering oyster-culture. The public has, even to a remarkable degree, been extravagant in supporting financially almost every experiment at artificial culture; this interest being doubtless caused by the increasing price of oysters, and not a little influenced by the proofs of the successes of continental culturists, which were notably shown at the International Fisheries Exhibition held in London in 1883. Scientists, foremost among whom was Prof. Huxley, became greatly interested in the biological side of the oyster problem and were always willing to offer their counsel. Parliament in important sittings discussed at length the matter of fishery legislation*, published reports on foreign methods of culture, and investigated with the greatest minuteness and care, by select committee, the causes of failure of spat and of the decadence of the industry.

But with all these cares there was ever in the way an obstacle which people and Parliament, in spite of the temporizing experiments of the past quarter of a century, have been unable to successfully evade. To what degree would it be wise on the part of government to absolutely restrict the public fishery in preserving public lands? This question is clearly one that comes directly in conflict with the ancient rights of individuals in the public fisheries. To effect decided changes, perhaps even minor ones, in this fishery system, would be an absolute measure which touches the liberties of the British subject, and would be opposed just as even the concessions that have been granted for cultural purposes are seriously criticised as reducing the public grounds and robbing the dredger of ancestral rights. Parliament has endeavored to move conservatively, and has itself considered and granted by special act all of the newer concessions. Its action, however, appears to be more and more regulated by the advisory reports of the fishery inspectors of the Board of Trade, a board which thus becomes directly intermediate between Parliament and people. On the part of the fishermen the position of the ancient Fishmongers' Company is one of great influence. This company, as is well known, does the most beneficial and disinterested work in assuring the character of the fish supply of London, and in the efforts to regenerate the oyster fishery its action in assisting the government is wise and exceedingly liberal. Its recent position in restricting the sale of oysters during the summer has already been noted (p. 397).

Conservatism on the part of the government as to public rights in natural oyster regions has given the dredgers every possible opportunity to carry on their industry unrestrictedly, excepting of course during the summer months. If no more stringent methods have been undertaken, it has been partly because there have been no pressing complaints on the part of culturists for the betterment of the industry. To purchase seed oysters raised artificially on the Continent has been an alternative not distasteful to Auray or Zeeland, not lacking in profit to the English culturist, and giving the British market an abundant supply of oysters, but a supply for whose expensive production the public must pay. The dredger is gradually finding that his ancestral right to the public grounds, which he has struggled to retain, and which government has generously allowed (giving him the benefit of the doubt as to whether its preservation would not in the end prove more valuable), is not after all of great value in the absence of natural oysters, and that all the profits in the industry must belong to capitalists and companies who deal in foreign oysters, and in whose employ he can himself most profitably make a living.

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*Report of Select Committee (House of Commons), July 7, 1876.

CONCLUSION.

A summary has now been given of the present character of the oyster industry i Europe. The intention has been, first, to give a glimpse of the actual processes o oyster-culture, and, second, to show in a general way the influence exerted upon th industry by governmental concessions or restrictions. Together with these a numbe of questions relating to the living conditions of the oyster have been discussed, an as the interest connected with them may, in several instances, be more than theoretica they may be briefly summarized. It would appear, for example—

1. That the degree of density of the water is one of the most important facto influencing the spawning and fattening of the oyster. This degree of salinity, whic represents the *optimum* of spawning conditions, has been found in all countries to b delicately poised. The density of the water recorded in the best spawning-ground of the French coast is practically that of the spawning-grounds of Italy and of northern Europe. It may be stated that the specific gravity of the water in regions o maximum production throughout Europe appears to be uniform at about 1.023* in th case of the "flat" oyster (*Ostrea edulis*), and at about 1.021 in the case of the Portugues species (*Ostrea angulata*). The influence of warmth is not to be underestimated i regard to the time and degree of spawning; it is meant, however, that in one zone o locality, *i. e.*, bay or estuary, where the water density is favorable, there is a mo decided tendency to a fall of spat than in a locality of corresponding temperatu immediately neighboring, where density may differ by only a few thousandths (*e.g.* 0.00 of a degree.

2. That the amount of spat occurring annually in a region appears to be directl in proportion to the number of spawning oysters in that region. This is by no mea a novel suggestion; it is one, however, that has been repeatedly impressed upon th writer. The older idea, it will be remembered, is that banks can never be exhauste on the ground that the few oysters left by the dredgers will, by the annual spawnin of several millions of young, cause a very rapid regeneration. That the banks regenerate is true,† but the process is shown to be slow, and beset with many difficultie The older proposition is, in brief, untenable, because, as Möbius pointed out,‡ the percentage of loss of oyster fry is apparently a normal factor (under natural conditions It may be seen, as an illustration, that the immense annual spawning product of on oyster may in time give rise to no more than two adults; and from a practical standpoint, accordingly, the large number of eggs produced by a single oyster would mak little difference in the growth of the natural bed. It should be noted that only i those places in Europe where the natural bulk of spawning oysters is actually maintained does a great quantity of spat occur regularly; also that where the number o spawning oysters is equal the percentage of spat will be notably greater if the spawning oysters are little disturbed.§

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* The observations were made at nearly corresponding seasons.

† Möbius, *loc. cit.*, p. 77.

‡ Möbius, *loc. cit.*, p. 79.

§ Cf. Hoek., *loc. cit.*, p. 481.

3. That the amount of oyster food appears to be notably characteristic of a locality whose normal food value is represented by conditions of warmth, density, and richness in the organic and inorganic salts, which serve to rapidly generate the oyster-food organisms. Should this natural food value of a locality be a high one, culture has demonstrated empirically that the number of oysters that may be reared is exceedingly great. It would appear that the number of oysters to be fattened is directly proportioned to the food normal of the locality and to the volume of water which passes over the bed. The actual size of a natural oyster bed is limited by other reasons than that of failure of the food supply in the neighborhood.

The study of the management of the natural oyster-grounds of Europe has been a suggestive one, not as much in regard to attempts made to render them more fertile and more serviceable in directly supplying the markets, but in their indirect yet important bearing upon the production of seed in neighboring areas. This system of stated oyster reserve has been the key to the success achieved by the French and Dutch industries, and has alone rendered it possible for these two countries to supply the entire seed market of Europe.

To obtain seed oysters by collectors is shown to be possible only when a regular yearly fall of spat is thus assured. Proximity to a large stock of spawning oysters is one of the imperative conditions of artificial production, a condition that has been too often lost sight of in experiments made along the Atlantic coast of the United States. Collectors in Europe are placed on no river bank or sunk in no stream save where the culturist is fairly sure of a set that will be at least profitable.

If experiments in artificial production are to be made in the United States the suggestion given by European oyster-culture is to secure for the purpose a particular part of beach near the line of low water, where spat has been found to regularly occur. If a trial demonstrates that the locality is favorable, the European culturist would then gradually and carefully expend his money in the purchase or preparation of a more extended area for collecting, and would study to provide the most suitable form of collector.

It may be said, in passing, that experience has found no more economical collector than the tile. This has proven especially valuable in adapting itself to the needs of the locality, may be spread singly over hard beaches, where there is no danger of sediment, and may in muddy regions be arranged in banks or *champignons*.

There can be no doubt that artificial production would succeed in American waters. The question is the practical one, whether it would, on an extended scale, be less costly than the price of natural seed. This can only be determined by experiments in a favorable locality.

Artificial production, it will be remembered, is largely carried on near the line of low water. Open tidal ponds, utilizing for this purpose a higher zone of the shore, have as yet never given the best results. In closed tidal ponds the small water volume has never been successfully aërated for the needs of production: the use of a closed lake whose large size shall insure aëration naturally may prove permanently successful and should not be lost sight of.*

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* U. S. F. C. Bull., 1890, p. 372.

The phase of European oyster-culture that has as yet no equivalent with us at home is that of the extreme value of land at particular points. Competition in these favored localities has added in various ways to the area of production and culture. Land is made by the macadamizing of soft and useless tracts; a higher zone of the beach is utilized by tidal inclosures; wire cases raise the oyster from the muddy bottom and protect it from its enemies; and in Italy *vertical* culture is even resorted to in a very extraordinary way. (See page 360.)

The general need in the United States for area in which to extend oyster-culture can hardly be regarded as immediate. At points, however, where the local cultural conditions are exceedingly favorable to rapid growth or fattening, it would seem a practical measure to bring into cultivation extended shore strips near the zone of low-water mark by the use of tidal parks of the least costly type.[*] In regions where softness of bottom and richness in the oyster's feeding conditions are noteworthy, the use of case culture is most strongly to be recommended, from its practical value. Culture in *claires* is easily understood;[†] its results in giving a special and delicate flavor to the oyster should commend it to culturists.

Significant, although perhaps not strictly logical, deductions may be drawn as to the way in which different action on the part of different governments has affected the prosperity of oyster-culture; the granting of concessions, the terms of tenure, the preserving of the natural grounds, interference or non-interference, have undoubtedly exerted much influence in developing or retarding the industry, although it is clearly to be understood that only the most general inferences can be drawn on account of altered conditions, *e. g.*, of climate. In the accompanying table (p. 406) a brief contrast has been attempted. It will be seen that in those countries alone where government has absolutely preserved supplies of spawning oysters does seed-culture flourish. The permanent closure of a small natural oyster-bearing area has apparently done what has not been done by a close season of the r-less months. The latter course, as argued by Prof. Huxley,[‡] does not prevent the dredgers from exhausting the banks before the spawning seasons begins; and Prof. Hubrecht[§] notes that for similar reasons the close seasons might equally well be during the winter as during the summer.

That absolute reservation of oyster-bearing land will have an immediate and important influence upon the production of seed in neighboring areas is a proposition which European experience seems to demonstrate; and the writer would suggest, as in his former report, that the matter of reservation seems far more pertinent to the needs of the American industry than any attempts at artificial production. Nor would the reservation of such a tract be an impracticable matter, at any rate as an experiment, and if its importance could be shown in a region where the seed industry has been prosperous and is now depleted, a government experimental control might give place to permanent measures on the part of individual State, or of local authority. If the importance of this question could, by experiment, be demonstrated clearly and practically, the culturists themselves would become the most actively interested in the matter. *The normal quantity of spat is in direct proportion to the number of spawning oysters in the neighborhood*, and, although this fact may be clearly recognized, the culturist must in general, for commercial reasons, remove and sell a large part of his stock, leaving in total remainder an amount whose spat product is an inadequate one. Authority can not forbid the culturist to remove the oysters before the spawning season, and political economy can not expect that one man will purposely leave a large stock of oysters to spawn for the common good of the neighborhood. Reservation is clearly a governmental duty, whether State or local. The matter is not a new one, and the condensed experience of Europe merely emphasizes what, with various modifications as to tenure, time, and degree, the authorities on this subject in the United States have already advised.

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[*] U. S. F. C. Bull., 1890, p. 376.
[†] *Loc. cit.*, p. 376.
[‡] Lecture on the Oyster, May, 1884.
[§] Int. Fish. Expos., Prize Essay, 1884, in Philpots, *loc. cit.*, p. 702.

Among the European systems of rental of state lands, the carefully devised method of Holland is worthy of consideration, especially as the matter of rental with us will become of greater importance as demand for cultural property increases. State policy in Holland has not hesitated to give short leases at competitive prices, on the ground that valuable land should not be continued in the hands of one who does not pay for it a just rental, and that the balance established by competition is apt to be fairest in the end to all interested parties, state, culturists, and public at large.

In conclusion the author must gratefully acknowledge the generous assistance of those whom he was obliged to consult during his visits of inquiry. For his notes on the German industry he is especially indebted to Prof. Karl Möbius, of Berlin, to Baurath Weinreich and Herr E. Storm, of Husum, and to the brothers Feddersen, of Schleswig. In Holland he must acknowledge the personal kindnesses of Prof. Hoek at the Helder, Baron Groeninx van Zoelen, Mr. J. Ochtmann, and the inspector of the Dutch fisheries, Mr. C. J. Bottemanne, at Bergen-op-Zoom. At Ostend he had the opportunity to meet M. Hamman, secretary of the Fisheries Board, and was very kindly presented to a number of culturists. To Cav. Domenico Pollio, of Pozzuoli, and to Sr. S. Milosa, at Fusaro, he must also express his indebtedness. In England he was received at the Board of Trade by Mr. A. P. Berrington and Mr. W. Fryer, and at the Fishmongers' Company by Mr. T. Wrench Towse, and was by the courtesy of these gentlemen introduced at the various centers of oyster-culture. He is also indebted to Capt. G. L. Austin and to Capt. A. Anderson at Whitstable, to Mr. A. C. Wanklyn and Mr. J. Newman at Colchester, and to Mr. J. Smith at Burnham.

SUMMARY OF EUROPEAN SYSTEM.

A. Of Management of Natural Oyster-Grounds:
  All are property of the state.
    (*a*) Dredged by licensed fishers with closed season of the summer months: England, Italy, Spain and Portugal, Germany.
    (*b*) Dredged exceptionally or never; beds to furnish spat for cultivated areas: Holland, France, Italy.
    (It is to be noted that in countries where the natural beds are absolutely closed to the public the seed-oyster industry is most prosperous, supplies local wants, and furnishes even in great part the neighboring countries). In the case of Italy the Mare Piccolo, the only region of extensive production, has virtually this restricted character.
B. Of Cultural Methods:
  (*a*) Production:
    (1) No seed oysters produced: Belgium.
    (2) Seed oysters produced naturally on natural oyster banks, no cultural devices, entire industry feeds on natural annual surplus of oyster banks: Germany, Portugal, Spain.
    (3) Seed oysters taken with collectors.
      (1*a*) On open shore near low-tide mark:
        Tiles in single layer: Holland.
        Tiles in banks, bouquet or champignon, wooden plateaux: France.
      (2*a*) In open deeper water:
        Floating collectors, fascine: Italy.
        Shell cultch: England; in part, Holland.
      (3*a*) In closed ponds, small, never with permanent success.
        In closed ponds, large: France (?), U. S. F. C. Bull., 1890, p. 372.
  (*b*) Élevage:
    (1) No artificial cultural processes, no transplanting: Germany.
    (2) Oysters planted along suitable foreshore: England; in part, Holland, Portugal.
    (3) Oysters reared during first year in wire-gauze cases, afterward reared entirely in tidal inclosures: France, Holland, Belgium, Spain.
    (4) Oysters reared to marketable size attached to collector, oyster-bearing ropes: Italy.
    (5) Special processes:
      Flavoring: France, Belgium, England; with color, France (Ostend?).
      Dégorgement: France.
      Special storage in tidal "pits" or ponds: England, Belgium (Germany).
(C) Of Granting Concessions of Cultural Lands:
    (1) Cultural property in general private, no government (aids or) restrictions: Belgium, (Ostend).
    (2) Cultural property governmental.
      (*a*) Concessions of freeshore rarely if ever granted for purposes of culture, extreme restrictions, long leasehold: Germany.
      (*b*) Concessions of, granted on long lease, nominal rental, by special governmental act, obtained with more or less delay and difficulty: England.
      (*c*) Concessions of, obtainable by direct petition of fisherman or culturist by aid of a local government official, prompt and direct, no cultural companies: France.
      (*d*) Concessions of similar, from local government, with subleaseholders: Italy.
      (*e*) Concessions of short leasehold, competitive rental: Holland.

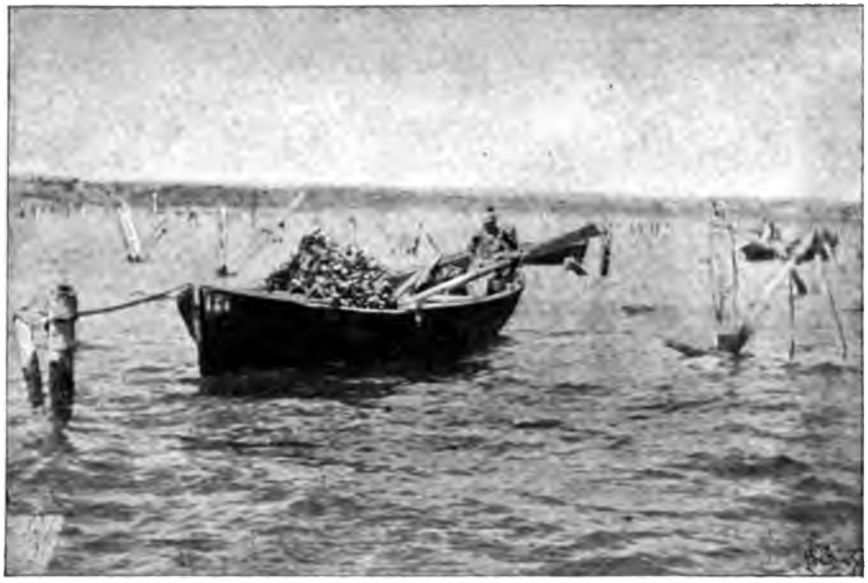

FIG. 1. TARENTE, ITALY. GENERAL VIEW OF MARE PICCOLO, TAKEN FROM THE CITY, LOOKING TOWARD THE MARINA DEL CITRELLO, SHOWING EXPOSED ENDS OF OYSTER STAKES.

The skiff load of oyster-bearing ropes is about to be put in place. (Page 359.)

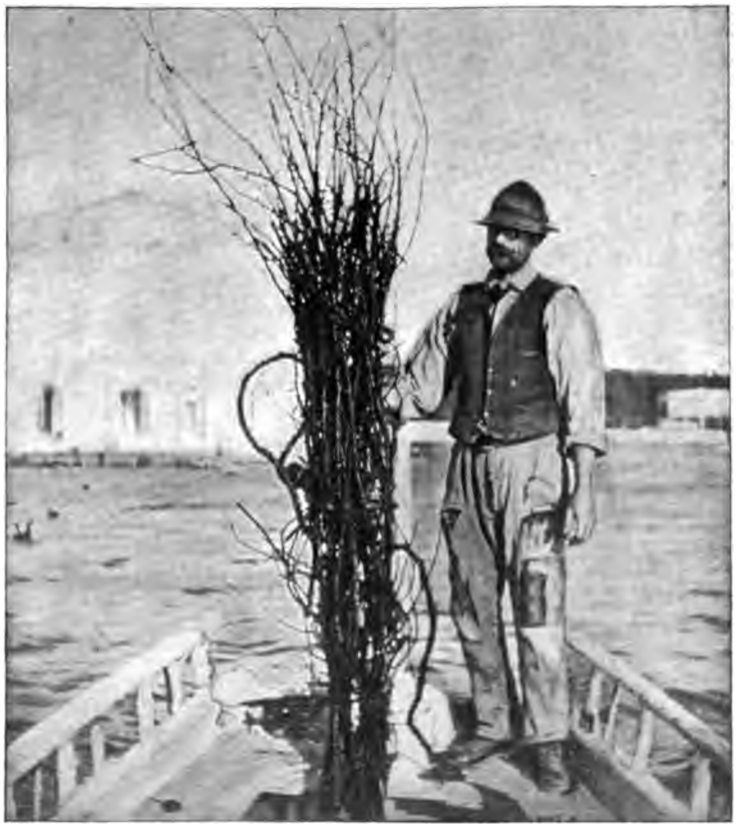

FIG. 2. FUSARO, ITALY. A FASCINE WITHDRAWN FROM THE LAKE TO EXAMINE THE CHARACTER OF THE SET.

Oyster stakes to which fascines are attached may be noted in front of the Pavilion Reale. (Page 364.)

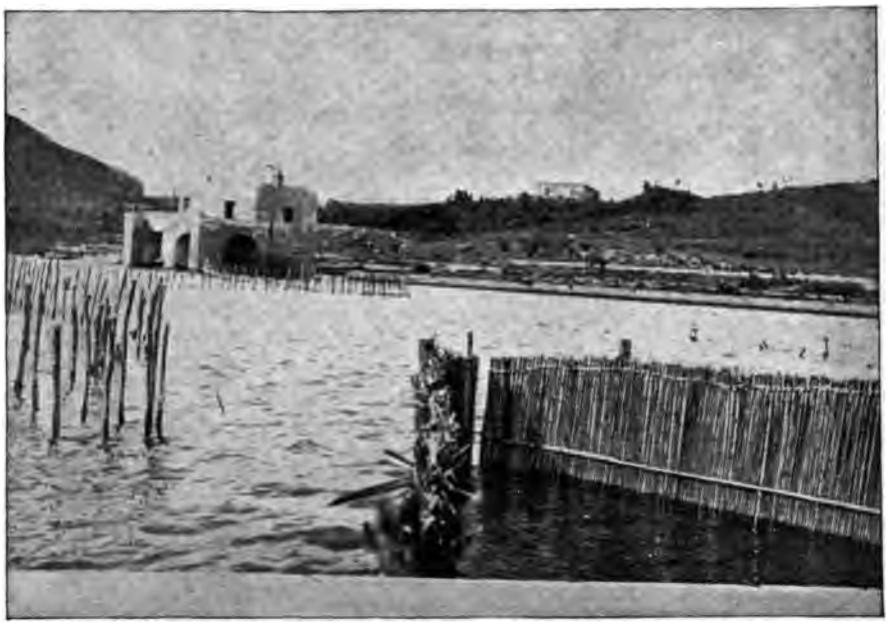

FIG. 1. LUCRINE LAKE, ITALY. GENERAL VIEW FROM THE HIGHWAY TO NAPLES, OVERLOOKING THE EASTERN END OF THE LAKE.

The foot of Monte Nuova forms the background at the right. The stakes at the left bear collectors and fascines for élevage. The fish runway of straw, seen in the foreground, leads to the sluice gate of the next figure. The location of Lake Avernus, the Acheron of Virgil, is directly behind the atelier shown in background. (Page 365.)

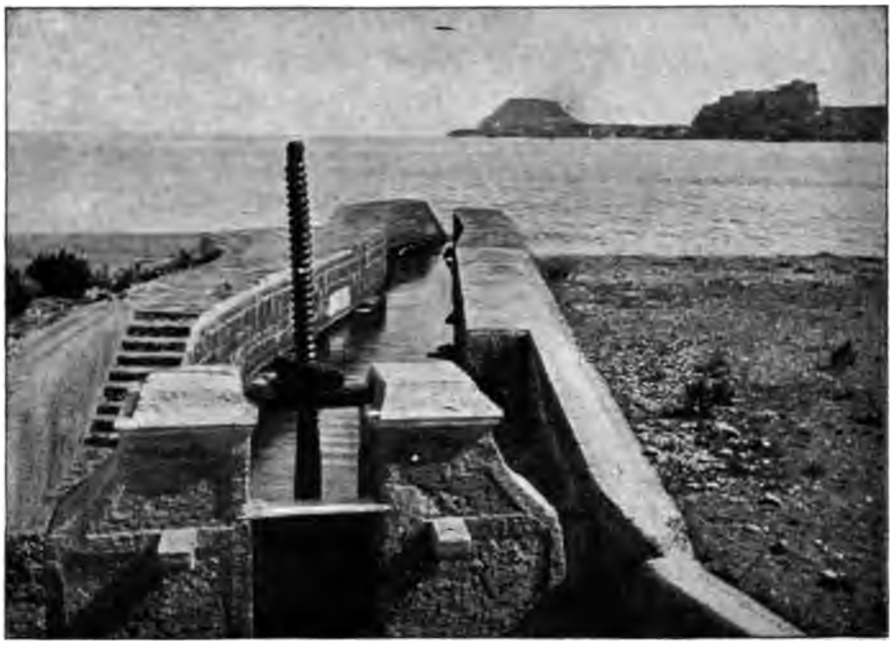

FIG. 2. LUCRINE LAKE, ITALY.

The tidal gate with stone breakwater, as seen from the road to Naples, Cape Miseno in the background. (Page 365.)

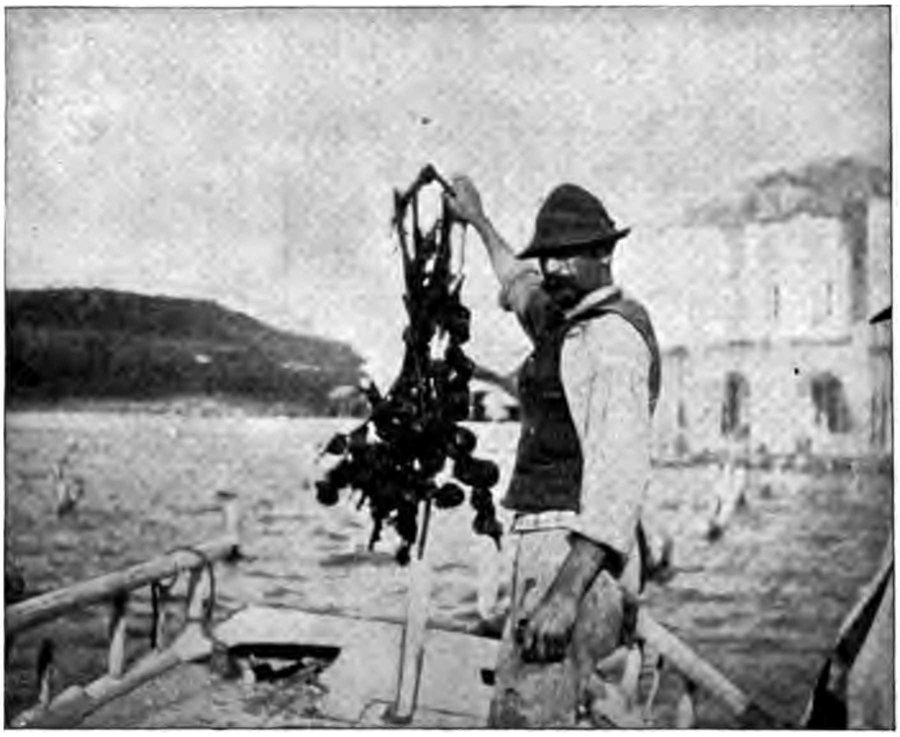

FIG. 1. FUSARO, ITALY. ÉLEVAGE OF OYSTERS OF SECOND YEAR; A REARRANGED FASCINE SEEN AS LIFTED FROM THE WATER. (Page 364.)

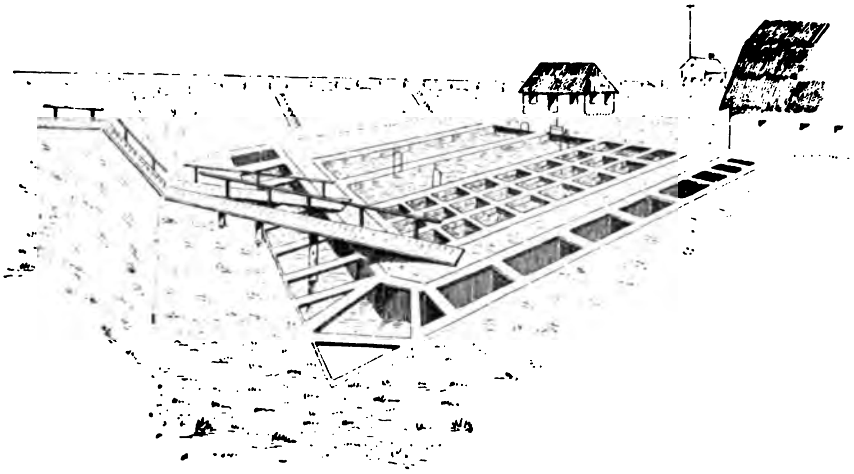

FIG. 2. HUSUM, GERMANY. GOVERNMENT STATION AND OYSTER-STORAGE PONDS.

The bank of the Husum Canal is seen at the left over the marginal dike. Behind the embankment in the background is the reservoir, whose water passes into the main middle storage pond through the water gate seen in front of the house. Thence the water passes into the lateral ponds, thence to the surrounding U-shaped reserve canal, escaping at the left, piercing the dike. From sketch by the writer. (Page 377.)

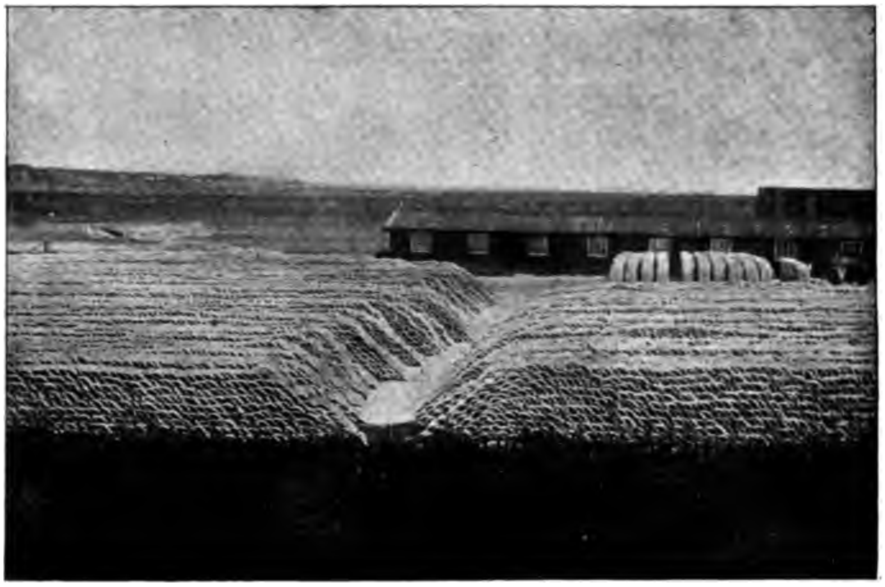

FIG. 1. VIEW OF AN ESTABLISHMENT AT BERGEN-OP-ZOOM, HOLLAND.

The dark foreground is the sloping landward side of the dike. The chalk-covered tiles are arranged ready to take over the dike, and be loaded upon the fishing vessels and transferred to the collecting grounds. The workshops are seen, and at the left over the tiles the margin of a culture pond. This land was formerly a polder. (Page 384.)

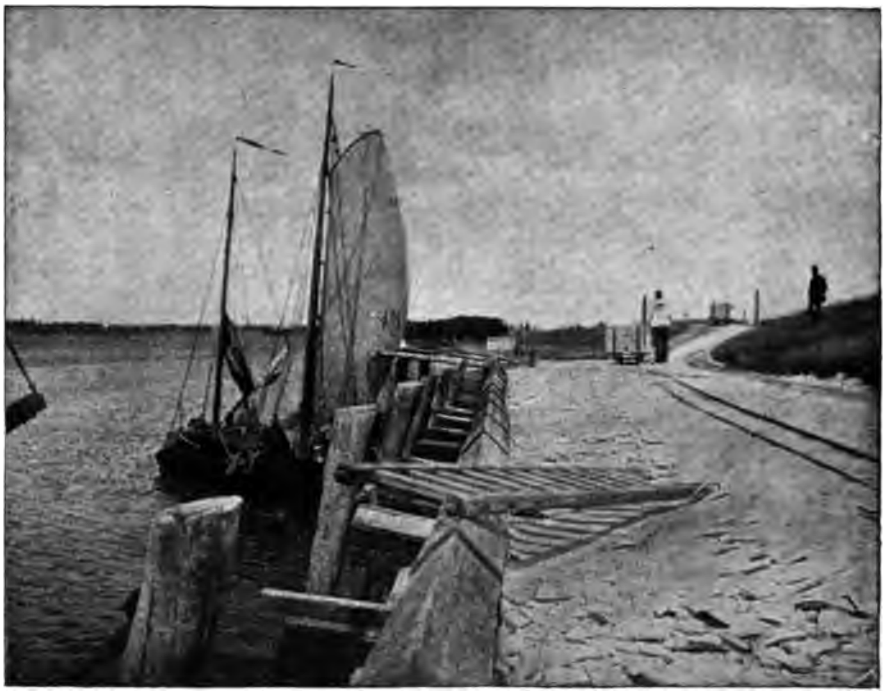

FIG. 2. FISHING BOATS RECEIVING CARGO OF TILES FROM THE ESTABLISHMENT SHOWN IN FIG. 1.

A hand railroad is seen bringing the tiles over the crest of the dike. (Page 384.)

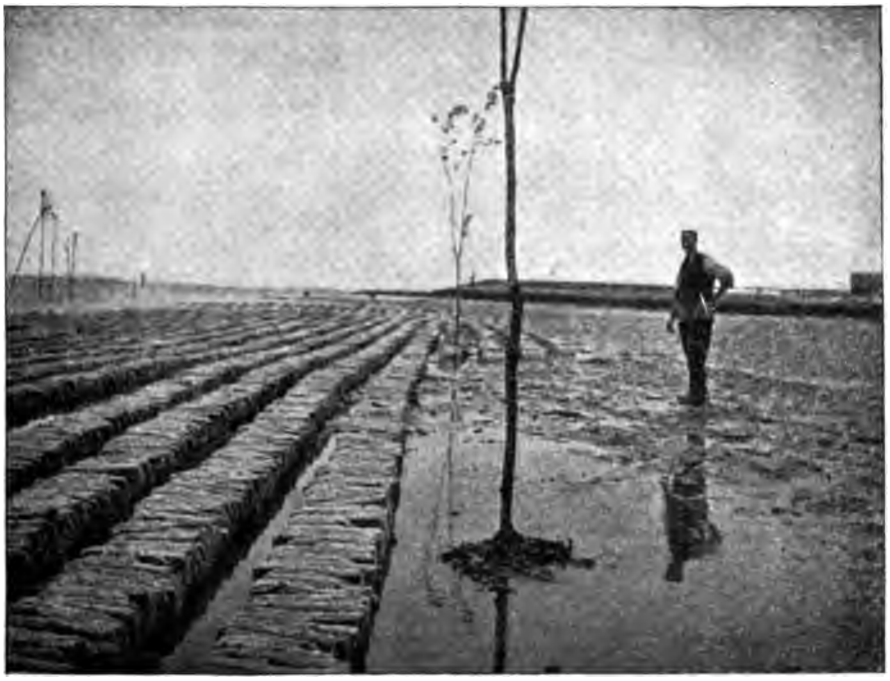

FIG. 1. JERSEKE-DAM, HOLLAND. A COLLECTING GROUND AT LOW TIDE.

The tiles have just been arranged in fringing rows. The boundary stakes may be noted. An outcropping corner of the dike forms the background at the right. Property of Baron Grœninx van Zoelen. (Page 384.)

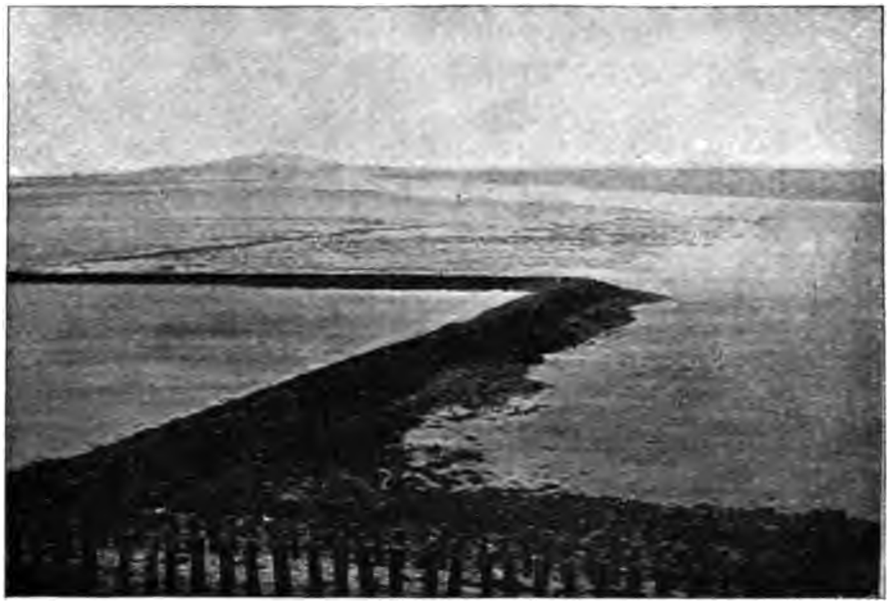

FIG. 2. GOES, HOLLAND. A COLLECTING GROUND AT LOW TIDE.

The sides of the channel seen in the background are fringed with tiles. A corner of a tidal reservoir for storage is in the foreground. Property of Mr. Ochtmann. (Page 383.)

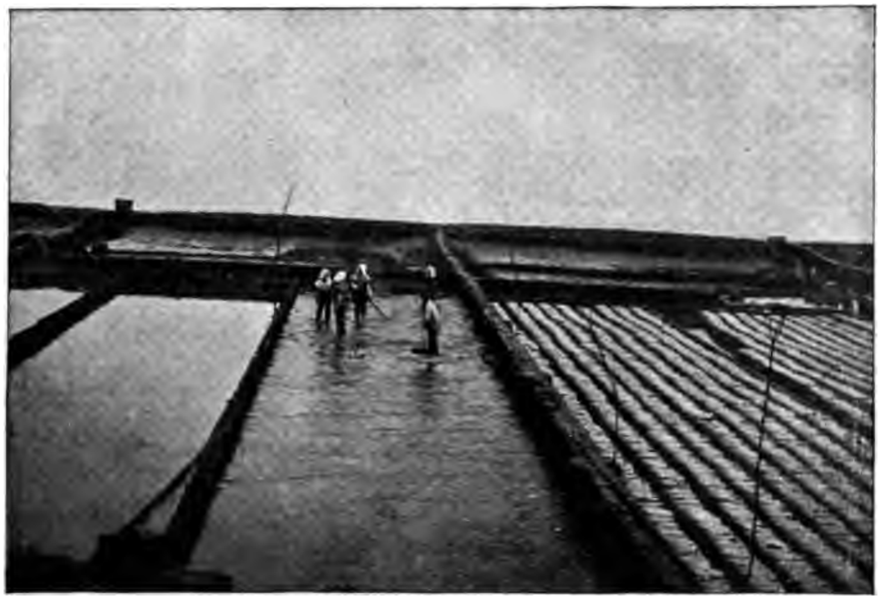

FIG. 1. JERSEKE-DAM, HOLLAND. TIDAL INCLOSURES FOR CULTURE AND FOR WINTER STORAGE OF TILES.

The work people are engaged in cleaning the middle pond for storage of tiles. (Page 384.)

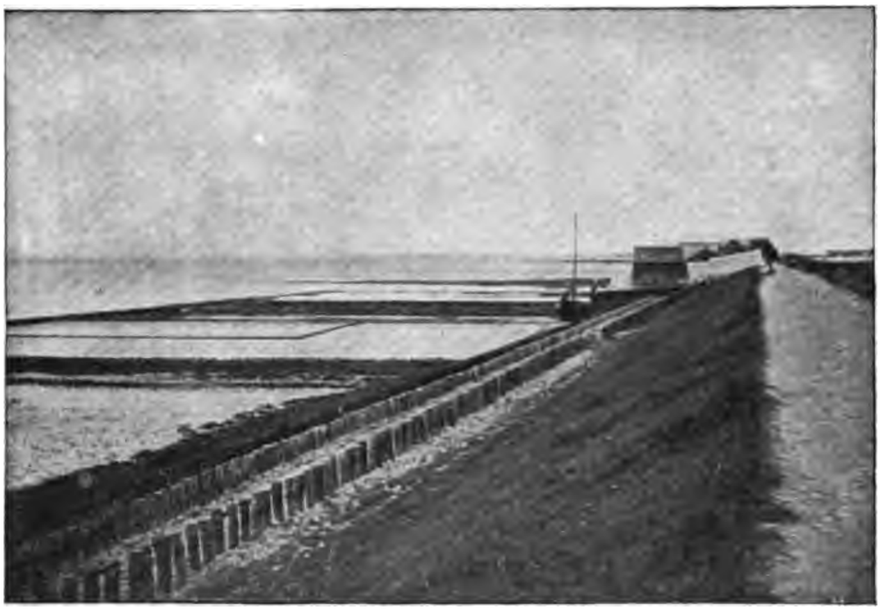

FIG. 2. GOES, HOLLAND. A SERIES OF TIDAL INCLOSURES (PARCS) SKIRTING THE DIKE.

Boundary stakes are indicated at the left. (Page 385.)

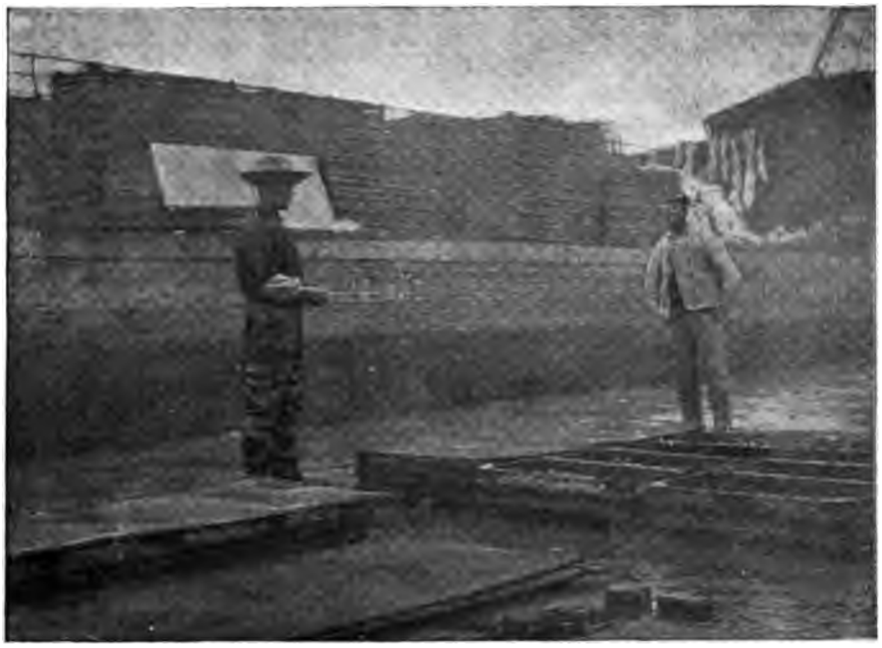

FIG. 1. JERSEKE-DAM, HOLLAND. A CULTURAL INCLOSURE OF THE BETTER CLASS, EMPTIED FOR PURPOSE OF CLEANING.

Wire gauze cases for élevage are seen, arranged so as to be two trays deep. Water, to the depth indicated on the brick wall, is renewed once in twenty-four hours. (Page 385.)

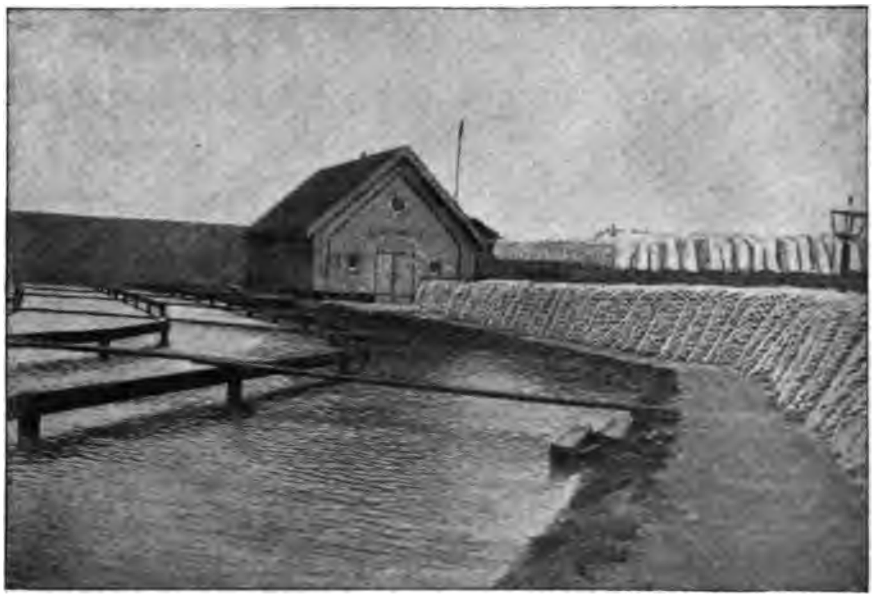

FIG. 2. BERGEN-OP-ZOOM, HOLLAND. VIEW OF A REARING POND.

This establishment has been located within the lines of the dikes, which is seen in the background of the picture. Several ponds are arranged similar to the one figured. The margins are of turf; the water depth, renewed at high tide, is about 3 feet, the bottom is clayey loam; the transverse beams are of service in handling and transporting the oysters. The ponds serve to retain the spat-covered tiles during the winter season. Further élevage is carried on (1) by placing the seed (i. e., young separated from tiles) into the wire-gauze cases; (2) by strewing the somewhat larger oysters directly upon the pond bottom. (Page 385.)

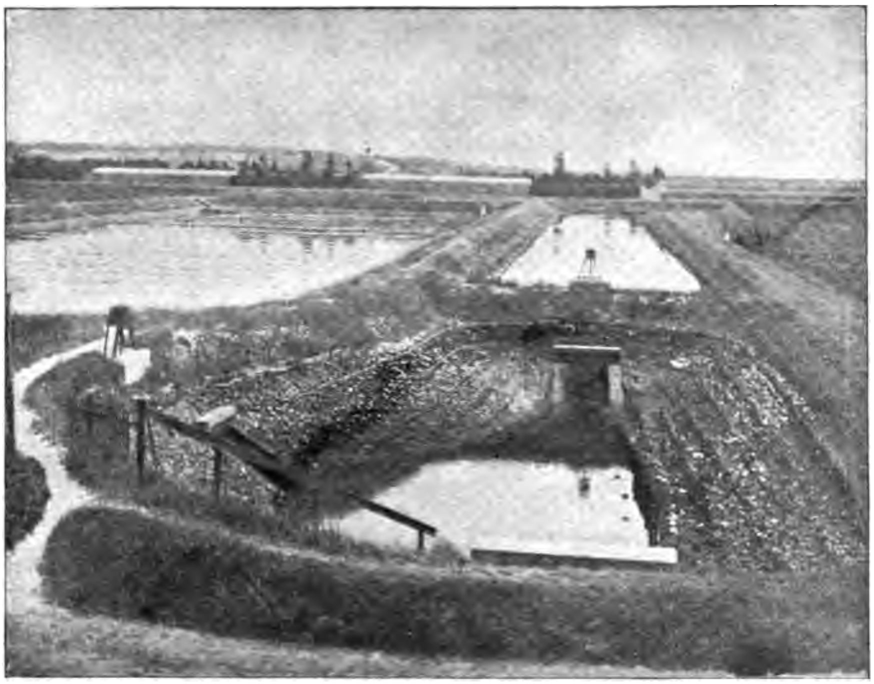

FIG. 1. BERGEN-OP-ZOOM, HOLLAND. VIEW FROM THE DIKE ACROSS POLDER LAND NOW IN USE FOR OYSTER PONDS.

The rough pond in the foreground is emptied and filled tidally from the main canal without. The incoming muddy water here deposits a portion of its silt, and thus purified passes into the long, narrow reservoir pond to the right of the center of the picture, also into a similar reservoir pond whose sluice is seen at the left. The water thus reserved and enriched by the growth of food organisms, is daily fed to the larger pond, which indicates at the water surface the position of culture cases. (Page 386.)

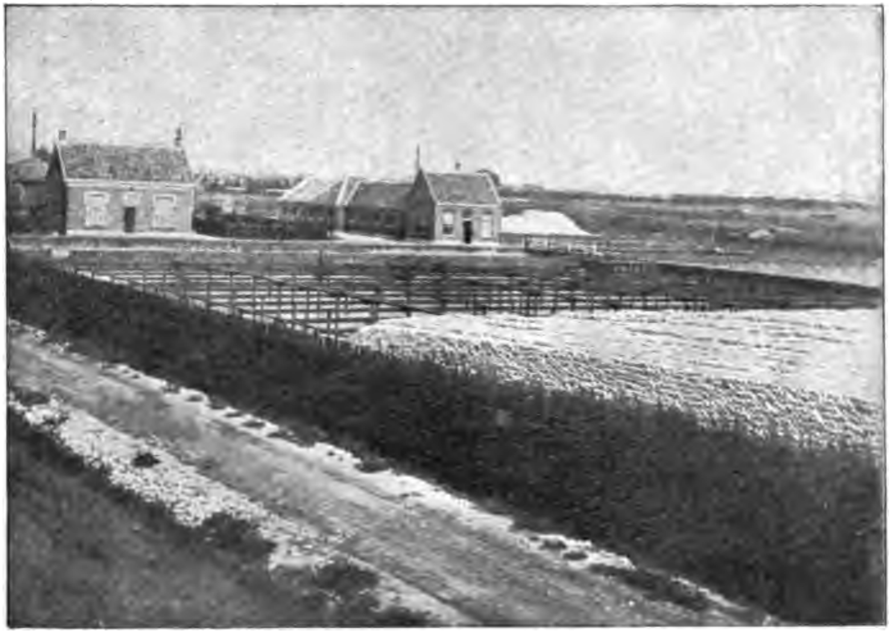

FIG. 2. BERGEN-OP-ZOOM, HOLLAND. AN ESTABLISHMENT NEIGHBORING AND SIMILAR TO THE LAST. WORKSHOPS IN THE BACKGROUND WITH RESERVOIR PONDS.

The cultural pond in the middle is traversed by beams which facilitate the transport of oysters to different points of the pond. Tiles about to be put in use for collecting spat are arranged for storage at the right.

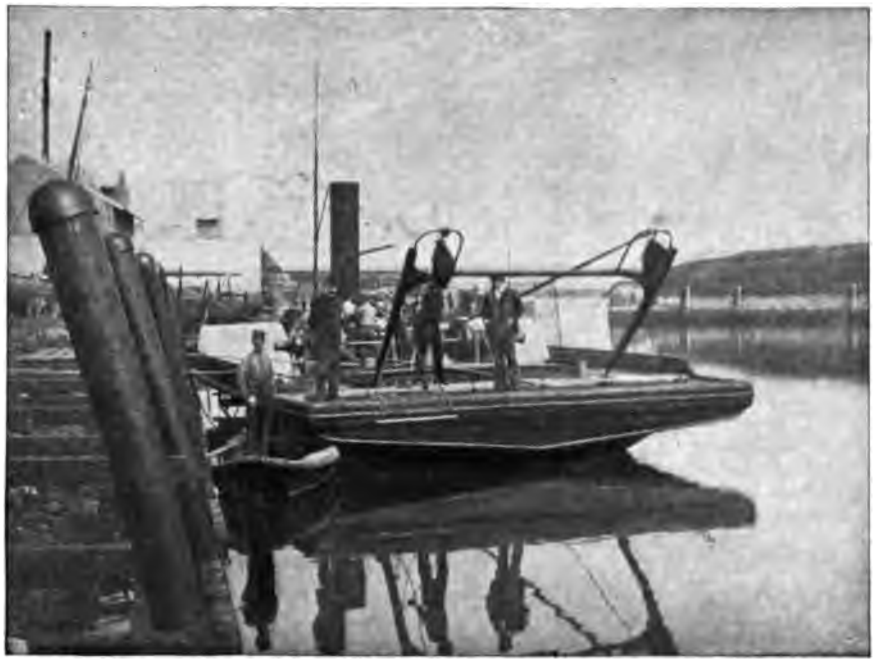

FIG. 1. HOLLAND. A NETHERLANDS STEAM OYSTER DREDGE, A SIDE-WHEELER EXTREMELY BROAD OF BEAM (BELONGING TO MR. OCHTMANN, BERGEN-OP-ZOOM).

The figure shows the long windlass of a donkey engine placed amidships, a reel at the stern over which the incoming lines pass, and a high-arm bar which helps to raise and empty the dredge. An example of the ordinary dredge will be seen hanging at the stern. (Page 386.)

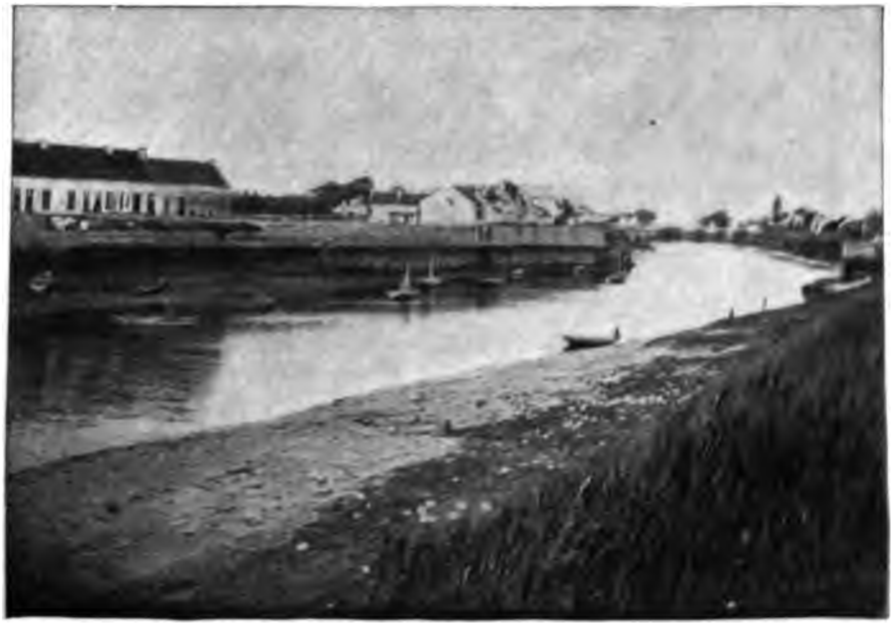

FIG. 2. OSTEND, BELGIUM. THE MAIN CANAL WHICH SUPPLIES WATER TO ADJACENT OYSTER RESERVOIRS, AS SEEN AT LOW TIDE.

Locks occur at various points, one of which is seen in the background. From that direction enters the fresher water which serves to reduce the density of the water mass of the canal. The degree of the fall of tide may be seen indicated by the water-line stain on the masonry wall. A sluice gate supplying and draining an adjacent oyster reservoir occurs near where the figure on the bank at the right is standing. (Page 389.)

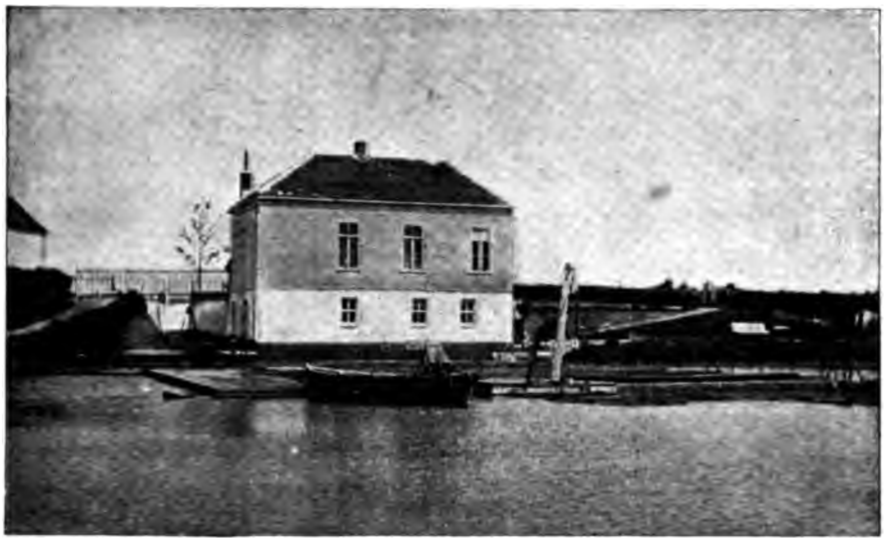

FIG. 1. OSTEND, BELGIUM. AN OYSTER RESERVOIR (CLAIRE).

The embankment in the background is the side of the canal of Pl. LXXXIV, Fig. 2. The sluice gate from canal is seen immediately to the left of the building. The main pond (p. 389) is the reservoir. Projecting from the water surface in front of the house, the margin of the masonry inclosure where the oysters are placed can just be seen. The water of the reservoir is allowed to pass through this inclosure and escape into the canal without. Park of Messrs. Stichert & Strake.

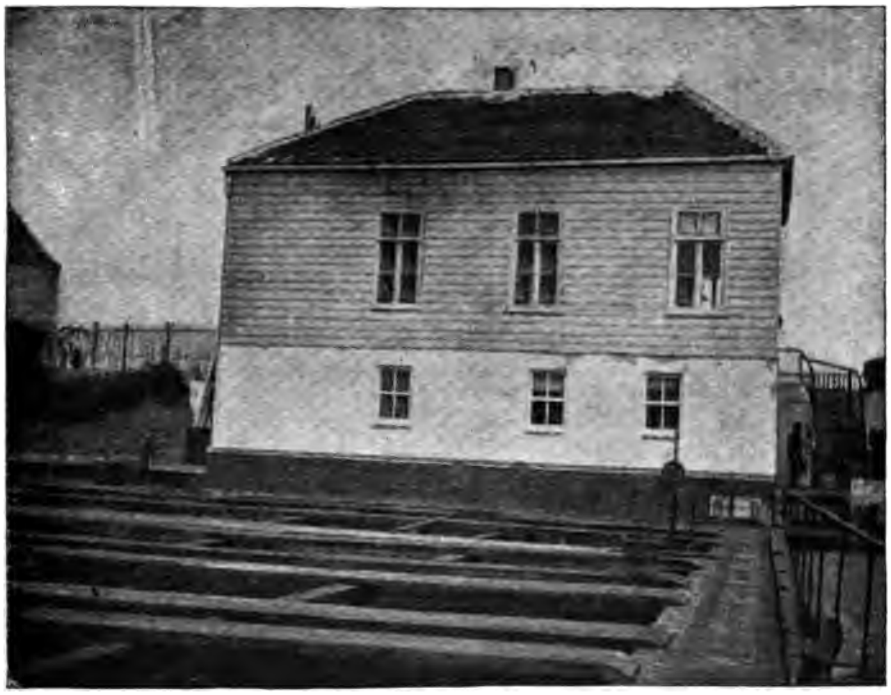

FIG. 2. OSTEND, BELGIUM. A NEARER VIEW OF ESTABLISHMENT OF FIG. 1, TAKEN FROM THE CORNER OF MASONRY INCLOSURE, WHERE OYSTERS ARE STORED AND FATTENED.

The inclosure is seen divided into masoned partitions and traversed with beams, which are used by attendants in arranging and transferring the oysters. The cog-lifting part of the sluice gate which allows the water to pass from one compartment to another is seen at the right, immediately behind the oyster basket.

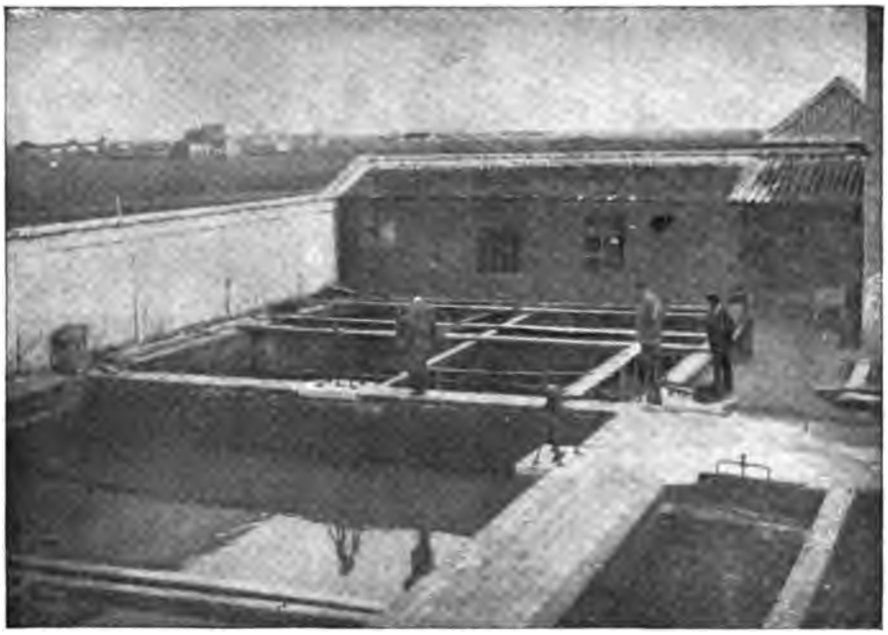

FIG. 1. BLANKENBERGHE, BELGIUM. THE OYSTER PITS OF DR. ANSELME VER NIEUWE.

A small reservoir pond is seen in the foreground at the right. The two large compartments are "pits" for storage and fattening. The different sluice gates are indicated; their level allows a depth of about 7 feet of water to be maintained. (Page 391.)

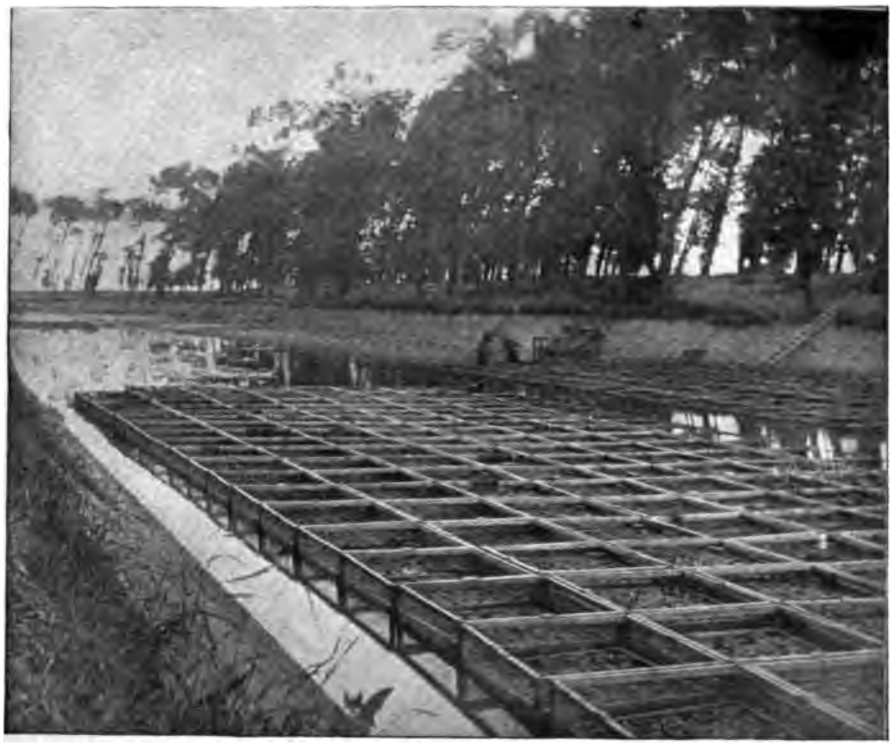

FIG. 2. NIEUPORT, BELGIUM. A CULTURAL POND OF THE ESTABLISHMENT OF MESSRS. MEINESZ & CO.

The water has been partly withdrawn, exposing the wire gauze frames containing tiers of trays of growing oysters. The attendants are engaged in putting in place frames which they have just retarred. The draining canal passes down the middle of the concreted bottom. (Page 391.)

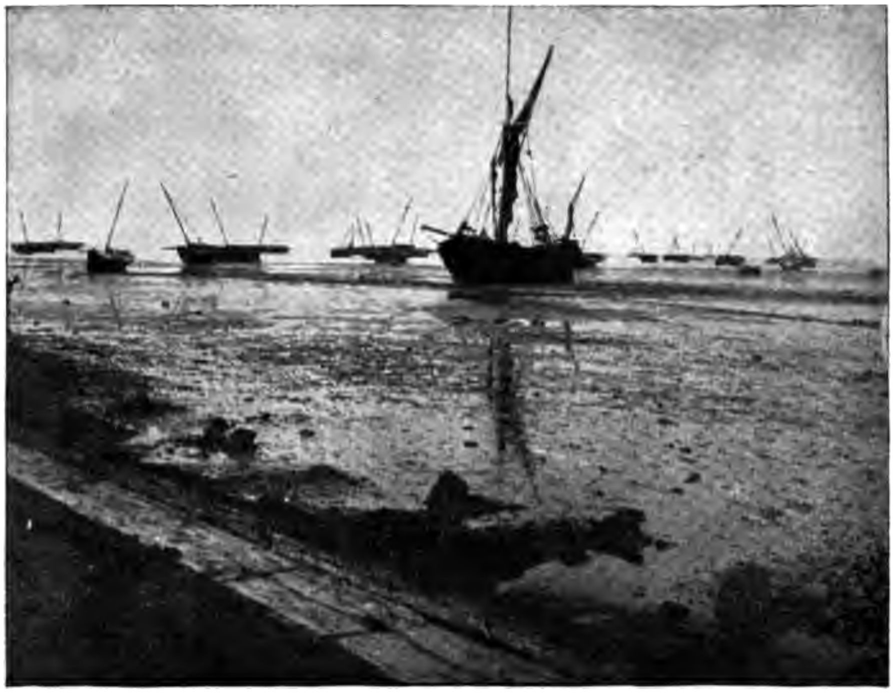

FIG. 1. WHITSTABLE, ENGLAND. GENERAL VIEW OF THE KENTISH FLATS AT LOW TIDE, FROM THE WINDOW OF THE WHITSTABLE COMPANY'S WAREHOUSE.

That the tidal flats are not of soft mud may be inferred from the tilting masts of the dredging vessels. (Page 398.)

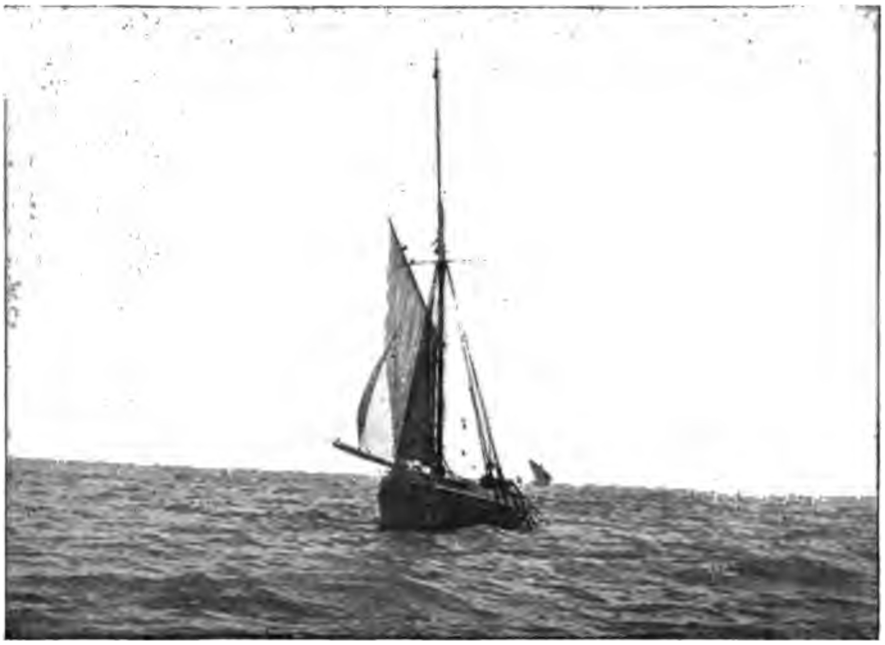

FIG. 2. WHITSTABLE ENGLAND. A TYPICAL DREDGING BOAT AT WORK. (Page 400.)

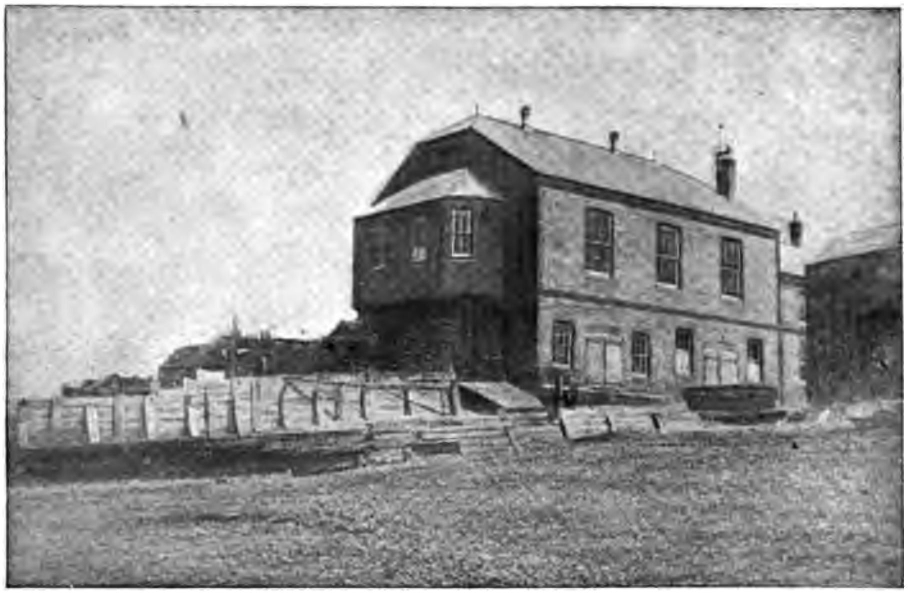

FIG. 1. WHITSTABLE, ENGLAND. WAREHOUSE OF THE WHITSTABLE OYSTER COMPANY, OVERLOOKING THE KENTISH FLATS.

The upper story serves as the meeting room of the freemen of the company. The basement is arranged with "pits" for storage. (Page 398.)

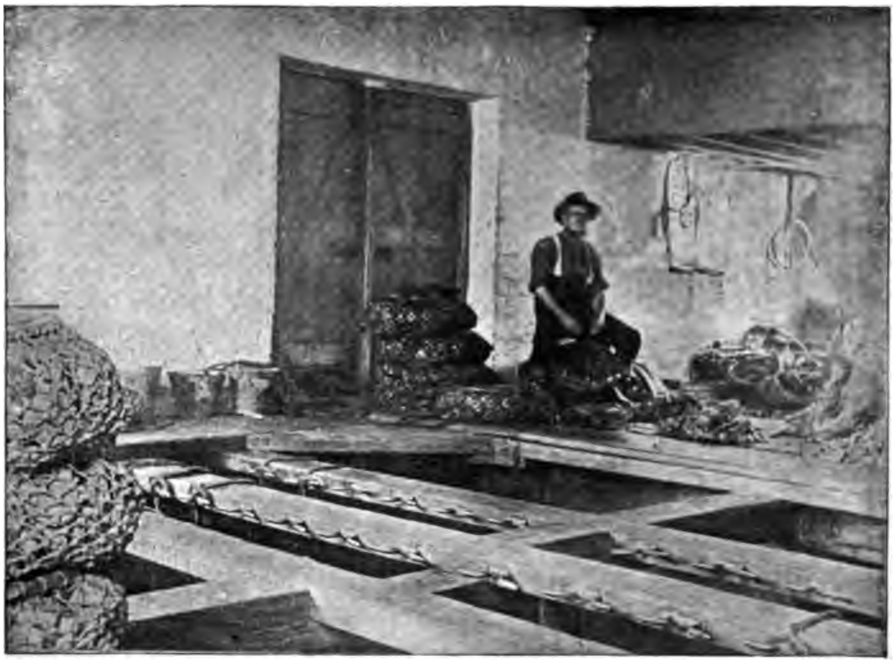

FIG. 2. WHITSTABLE, ENGLAND. THE STORAGE PITS OF THE WHITSTABLE COMPANY; SORTING THE OYSTERS.

The bag-like nets filled with oysters may be attached to the cleats seen in the foreground, and allowed to hang in the water of the pits. (Page 399.)

10.—ON THE CLASSIFICATION OF THE MYXOSPORIDIA, A GROUP OF PROTOZOAN PARASITES INFESTING FISHES.

BY R. R. GURLEY, M. D.,
Assistant, U. S. Fish Commission.

Up to the present time very little attention has been given to the diseases of fishes and to their parasites from the standpoint of the effect produced upon the host; yet there can be no doubt that a knowledge of such diseases would be of great practical value. Anyone who considers the proportions that fish epidemics sometimes attain will hardly be inclined to question the utility of searching investigation in this direction. Thus, to take a single instance, Prof. Forbes states * that in the epidemic of 1884 in Lake Mendota it was estimated that fully 300 tons had died. On August 7 the Madison Transcript reported that 200 tons of fish had been hauled away by the city authorities during the four weeks preceding and that the fishes were still dying. Epidemics of similar extent have been reported in Europe, for several of which (that of the barbel certainly, and that of the crayfish probably) the *Myxosporidia* are responsible.

The important results in the way of prevention of epidemics among domesticated animals and cultivated plants, obtained as the result of scientific investigation, afford ground for the hope that similar results may be obtained here. Obviously the first step in work of this kind is the collection of facts, especially those bearing upon the parasite, its nature, life history, intermediate hosts, enemies, and its connection (whether causal or otherwise) with diseases or other morbid processes in its host. Such data are a necessary preliminary to preventive or curative measures.

The present paper and a more extended one now in preparation are intended as contributions to the objects indicated. In the latter paper the practical bearings of the subject will be fully discussed, and all the data as to epidemics of myxosporidiosis will be given. At present it is desired mainly to discuss the classification of the subclass *Myxosporidia* Bütschli and to record such genera and species as a study of the literature and of such material as was available has led me to recognize. These forms will all be fully described and figured in the second paper. The present only includes such true *Myxosporidia* as have received or appear entitled to receive binomi l names, and only such synonymy as is needed for their identification.

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* Bull. U. S. Fish Com. 1888, VIII, p. 482.

CLASSIFICATION OF THE SUBCLASS.

The only classification ever proposed is that of Thélohan.[*] This author ennunciates three taxonomic principles:

1. The habitat furnishes no sound basis for specific distinctions.[†]
2. The myxosporidium affords no taxonomic criteria.
3. The spores alone offer (at least in the present state of our knowledge) characters suitable to serve as a basis for classification. He says:

> By noting the differences of form and size of these elements, the number of their polar capsules, by taking account of the presence or absence of a vacuole in the plasma, of their number in the [pan]sporoblasts[‡], one can, I believe, succeed in obtaining elements sufficient for an attempt of this kind.

Thélohan further states that he regards the classification only as a provisional one, and that it is the result of a desire to obviate the great confusion arising from the habit of designating forms by their habitats.

The following is Thélohan's primary classification:

MYXOSPORIDIANS.

Spores....	Pyriform; capsule 1, at pointed extremity; vacuole 1, aniodinophile, at large extremity.			I. *Glugeidians.*
	Form variable.....	No vacuole; capsules 2 or 4.	Capsules 2...........	II. *Myxidians.*
			Capsules 4...........	III. *Chloromyxans.*
		Vacuole 1, iodinophile.	Capsules 1-2........	IV. *Myxobolans.*

The three principles mentioned, which form the basis of Thélohan's classification, are unquestionably sound as far as they go, but to obtain a satisfactory arrangement it will sometimes be necessary to employ additional characters and to arrange them in a different order of rank. Especially will it be necessary in the *Phænocystes* to refer constantly to the symmetry and topography of the spore.

Further, while there can be no question as to the propriety of drawing a sharp line between the "Glugeidians" of the above table and the remaining *Myxosporidia*,

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[*] Bull. Soc. philomat. Paris, 1892, IV, pp. 165–178.

[†] While as a general principle this is beyond question, indications are not wanting to show that in some cases the seat and, to a somewhat less extent, the host, bear some relations to generic lines. One of the most significant facts of organal and zoölogical distribution is the following:

Forms.	Total number of species.	Gall and urinary bladders, bile ducts and urinary tubules.	Remaining organs.
Non-vacuolous............	9	8	1
Vacuolous................	Very many ...	*Ad plur* 2 (3 ?)	All but 2 (or 3).

[‡] *Pansporoblast:* The transparent plasma-sphere formed by the condensation of a portion of the plasma around one of the numerous nuclei of the endoplasm of the myxosporidium; in distinction from the sporoblasts which result from the segmentation of the pansporoblast.

the division certainly can not rest upon such a comparatively unimportant character as the shape of the spore. I have regarded this division as of ordinal value and define the two orders thus:

I. *Cryptocystes* ord. nov. *Myxosporidia* in which the pansporoblast produces many (at the fewest 8) spores; the last minute, without distinct symmetry, with a single capsule; type (and only) family, *Glugeidæ* fam. nov.

Etymology: *κρυπτός*, concealed; *κύστις*, capsule.

II. *Phænocystes* ord. nov. *Myxosporidia* in which the pansporoblast produces few (at the most 2) spores;* the last relatively large, with distinct symmetry and 2 or more capsules;† type family, *Myxobolidæ* fam. nov.

Etymology: *φαίνω*, I appear; *κύστις*, capsule.

I. CRYPTOCYSTES ord. nov.

GLUGEIDÆ fam. nov.

Glugeidées Thélohan, 1892, Bull. Soc. philomat. Paris, IV, pp. 173-174.

Definition (provisional as regards negative characters): *Cryptocystes* destitute of a bivalve shell; with the capsule at the anterior extremity and with an aniodinophile vacuole; type genus, *Glugea* Thélohan.

This family contains three genera,‡ whose relations are shown in the following table:

Myxosporidium.	Spores formed in pansporoblast.	Pansporoblast membrane.	Genera.
Present	Inconstant, numerous	Not subpersistent	*Glugea* Thélohan.
Absent	Inconstant, numerous	Subpersistent	*Pleistophora* gen. nov.
Absent	Constant, 8	Subpersistent	*Thélohania* Henneguy.

GLUGEA Thélohan, 1891.

Compt. Rend. hebdom. Soc. Biol. Paris, III, p. 29; *ib.* Thélohan, 1892, Bull. Soc. philomat. Paris, IV, p 174.

Definition: *Glugeidæ* possessing a myxosporidium, and in which the pansporoblast produces an inconstant but large number (always more than 8) of spores; pansporoblast membrane not subpersistent; type, *G. microspora* Thél. (synonym for *G. anomala* Moniez).

Glugea anomala Moniez, 1887.

Nosema anomala, Compt. Rend. Acad. Sci. Paris, CIV, p. 1312; *Glugea microspora*, Thélohan, 1891, Compt. Rend. hebdom. Soc. Biol. Paris, III, p. 29.

Glugea destruens Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, pp. 165, 174 (footnote).

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* Three asserted in one species (Leydig, Müller's Archiv., 1851, p. 229).

† Except (at most) two *Myxobolus* species (one of them perhaps inconstantly), which have suffered reduction to one.

‡ Thélohan recognizes only 2 genera, the distinctions between which are mainly based upon the three characters noted. If (as both he and I believe) these characters are sufficient to determine genera at all, a third genus must be recognized, as *Pleistophora typicalis* sp. nov. could not (as the above table shows) well be forced into either of the existing ones.

PLEISTOPHORA[*] gen. nov.

Definition (provisional as regards negative characters): *Glugeidae* destitute of a myxosporidium and in which the pansporoblast produces an inconstant but large number (always more than 8) of spores; pansporoblast membrane subpersistent (as a polysporophorous vesicle); type (and only) species, *P. typicalis* sp. nov.

Pleistophora typicalis sp. nov.

(Corpuscles of *Cottus scorpio* Thélohan, 1890, Annal. de Microgr. Paris, II, pp. 203, 212; *ib.* Thélohan, 1891, Compt. Rend. hebdom. Soc. Biol. Paris, III, pp. 27–8; *ib.* Henneguy and Thélohan, 1892, Annal. de Microgr., IV, pp. 618–619, 622, 631, 636.)

Pansporoblast: Spherical, diameter 15 to 18 μ.

Spore: Ovoid; length 3 μ; breadth 1.5 to 2.0 μ; chromatophile granules *ad plur.* 4.

Habitat: Interior of fibrillæ of muscles of *Cottus scorpio;* diseased mass forming white streaks 5 to 6 by 3 mm.; not leading to muscle degeneration.

THÉLOHANIA Henneguy, 1892.

In Thélohan, Bull. Soc. philomat. Paris, IV, p. 174 (footnote); *ib.* Henneguy and Thélohan, 1892, Annal. de Microgr., IV, p. 639.

Definition (provisional as regards negative characters): *Glugeidae* destitute of a myxosporidium and in which the pansporoblast produces constantly 8 spores; pansporoblast membrane subpersistent (as an octosporophorous vesicle); type, *T. giardi* Henneguy.[†]

Thélohania contejeani Henneguy, 1892.

In Thélohan, Bull. Soc. philomat. Paris, IV, p. 174 (footnote).

Thélohania octospora Henneguy, 1892.

In Thélohan, Bull. Soc. philomat. Paris, IV, p. 174 (footnote).

Thélohania giardi Henneguy, 1892.

In Thélohan, Bull. Soc. philomat. Paris, IV, p. 174 (footnote).

Thélohania macrocystis sp. nov.

(Sarcosporidian of *Palæmonetes varians* Garbini, 1891, Atti Reale Accad. Lincei Roma, VII, Sem. 1, pp. 151–152, with figs.; myxosporidian of *ibid.* Thélohan and Henneguy, 1892, Compt. Rend. hebdom. Soc. Biol. Paris, IV, p. 586).

Sporophorous vesicle (subpersistent pansporoblast) elongate-fusiform.

Habitat: Muscles of *Palæmonetes varians* from the Mincio, near Verona.

II. PHÆNOCYSTES ord. nov.

It is in the classification of this order that the criteria furnished by Thélohan most need to be supplemented by considerations drawn from the *symmetry* of the spore. Considering the taxonomic importance of symmetry throughout the animal kingdom, it is strange that no attention has yet been paid to it in the *Myxosporidia.* But a little study of it shows that, whereas in all fusiform spores the pointed extremities have heretofore been loosely lumped together as "ends," those of *Myxidium lieberkühnii* Bütschli are not ends (*sens strict.*;=anterior and posterior), but sides; for the spore is symmetrical on either (right or left) side of the vertical plane,* but it is asymmetric on either (anterior and posterior) side of the transverse plane. On the other hand, if, as seems probable, the generic reference of *C.?* *diploxys* sp. nov. be correct, then "ends" in *Cystodiscus* are ends, properly speaking. It is needless to emphasize the taxonomic import of these results, for we are thus enabled to orient the spore and the results of such orientation may be summed up as follows:

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[*] Etymology: πλεῖστος, very many; φέρειν, to carry.

[†] I propose *T. giardi* Henneguy as the type of the genus.

1. Within this order the most important characters are the *position* and *grouping* of the capsules. Compared to this the mere *number* of these bodies is a character of minor importance; for not only has *Myxobolus* 1 or 2 and *Cystodiscus* 2 or 4, but the number even varies in the same species, *Myxidium lieberkühnii* Bütschli having 2 or 4.† But whether 1 to 2 or 2 to 4, the topographic relations are never varied. Thus in *Myxobolus* they are always in one group at the anterior end; in *Cystodiscus* in two groups, *anterior* and *posterior;* and in *Myxidium* in 2 groups, *right* and *left.*

Similar results are obtained with relation to the position of the valves, or, in other words, to the orientation of their plane of junction.

The following table shows the relations of these points to generic lines:

Comparison of generic characters in the Phænocystes.

[× = present; 0 = absent; ( ) = less usual; — = condition not known.]

	Symmetry.		Capsules.				Shell.				
	Antero-posterior.	Bilateral; perfect.	Number.	In one group (at the anterior end.)	In two groups.		Bivalve.	Inclination of plane of junction of valves to longitudinal plane.		Vacuole.	Tail.
					At the (anterior and posterior) ends.	In the (right and left) wings.		0°.	90°.		
Cystodiscus Lutz	×	×	2 (or 4)	....	×	....	×	....	×	—	0
Myxobolus Bütschli *sens. strict.*	0	×	2 (or 1)	×	....	....	×	×	....	×	0
Henneguya Thélohan	0	×	2	×	....	....	×	×	....	×	×
Chloromyxum Mingazzini	0	×	4	×	....	....	×	—	(?)	0	0
Mixosoma Thélohan	0	×	2	×	....	....	—[2]	—	—	0	0
Sphærospora Thélohan	0	×	2	×	....	....	×	—	×	0	0
Ceratomyxa Thélohan	0	([1])	2	×	....	....	×	....	×	0	0
Myxidium Bütschli	0	×	2 (or 4)	....	....	×	0	....	....	0	0

[1] Imperfect. Shell and capsules symmetrical; sporoplasm unilateral.

[2] From analogy and general similarity of appearance, this genus can hardly be other than bivalve.

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*The three planes to which symmetry may be referred may be thus defined:

Vertical plane: Median, longitudinal and intercapsular in position.

Transverse plane: Vertical, transverse and (in *Myxobolus*) postcapsular in position.

Longitudinal plane: Horizontal, longitudinal and percapsular in position.

† Balbiani, 1883, Journ. de Microgr. Paris, VII, p. 274, fig. 64 *g*.

From this table we may conclude that—

1. *Cystodiscus* Lutz is certainly entitled to separate family rank.
2. *Henneguya* Thélohan agrees with *Myxobolus* in every respect but one, the presence of a tail.
3. Thélohan's groups, "*Myxidiées*" and "*Chloromyxées*" must undergo rearrangement (see table below); for clearly *Chloromyxum* Mingaz, *Mixosoma* Thél., and *Sphærospora* Thél. form a compact group, with which *Myxidium* has no character of consequence in common except the absence of a vacuole.
4. *Sphærospora* and *Mixosoma* do not differ at all in the characters given (the distinction between these unispecific genera resting solely upon the shape of the spore), and the two taken together present only a single character in contrast to *Chloromyxum*, viz, the *number* of the capsules.
5. *Ceratomyxa* agrees sufficiently closely with *Chloromyxum* to permit its reference to the *Chloromyxidæ*.
6. *Myxidium* must form the type of a separate family.

The following table shows the relations of Thélohan's classification to the one now proposed:

Thélohan's classification.			Proposed classification.		
GROUP.			GENUS.	FAMILY.	CHARACTERS.
No vacuole, 2 or 4 capsules.	2 capsules. (II. Myxidians.)	Fusiform, 1 capsule at each extremity. *Myxidium* Bütschli.	*Myxidium* Bütschli.	*Myxidiidæ*.....	Bilateral but not antero-posterior symmetry; capsules in 2 groups right and left; no bivalve shell; no vacuole.
	Spores.	Elongated; shell, formed of 2 hollow-cone valves soldered along their bases. *Ceratomyxa* Thél.	*Ceratomyxa* Thél ..	*Chloromyxidæ*.	Bilateral but not antero-posterior symmetry; capsules in 1 group (at the anterior end); a bivalve shell, with the valve-junction plane perpendicular (?) to the longitudinal plane; no vacuole.
		Flattened-ovoid, more or less elongate. *Myxosoma* Thél.	*Chloromyxum* Mingaz, et sub-gen. *Sphærospora*.		
		Spherical. *Sphærospora* Thél.			
	4 capsules. (III. Chloromyxans.)	*Chloromyxum* Mingas.			
One iodinophile vacuole; 1 or 2 capsules.	IV. Myxobolans. Spore-shell.	Destitute of a tail; capsules 1 or 2. *Myxobolus* Bütschli.	*Myxobolus* Bütschli.	*Myxobolidæ*....	Bilateral but not antero-posterior symmetry; capsules in 1 group (at the anterior end); a bivalve shell with the valve-junction plane parallel to the longitudinal plane, an iodinophile vacuole.
		With a tail; capsules 2. *Henneguya* Thél.			
			Cystodiscus Lutz.	*Cystodiscidæ* ..	Bilateral and antero-posterior symmetry; capsules in 2 groups, anterior and posterior; a bivalve shell with the valve-junction plane perpendicular to the longitudinal plane; condition of sporoplasm unknown.

As a result of this analysis, the order *Phænocystes* may be divided into the following families:

CYSTODISCIDÆ fam. nov.

Definition: *Phænocystes* whose spores possess antero-posterior and bilateral symmetry; capsules in 2 groups, situated at the (anterior and posterior) ends; a bivalve shell, the plane of junction of whose valves is perpendicular to the longitudinal plane: condition of sporoplasm[*] unknown; type (and only) genus *Cystodiscus* Lutz.

CYSTODISCUS Lutz, 1889.

Centralbl. f. Bakt. u. Parasitenkde., v, p. 88.

Definition: Characters those of the family; type, *C. immersus* Lutz.

Cystodiscus immersus Lutz, 1889.

Centralbl. f. Bakt. u. Parasitenkde., v, pp. 84–88; figs. separately and subsequently.

Cystodiscus ? diploxys sp. nov.

(Psorosperms of *Pyralis viridana* Balbiani 1867, Journ. Anat. et Physiol. Paris, p. 335 (footnote), t. 12, f. 10–12.)

Spore: Parallel-sided fusiform; ends symmetrically double convex-curved pointed; plane of junction of valves coincident with the vertical plane; capsules 2 at each end, of equal size.

Habitat: *Tortrix viridana.*

MYXOBOLIDÆ fam. nov.

(*Myxosporidieæ*[†] Perugia, 1891, Boll. Scientif. Pavia, XIII, p. 23; "Myxobolées" Thélohan, 1892, Bull. Soc. philomat. Paris, IV, pp. 173, 176.)

Definition: *Phænocystes* whose spores are destitute of antero-posterior, but possess bilateral, symmetry;[‡] capsules in 1 group at the anterior end; a bivalve shell, the plane of junction of whose valve is parallel to the longitudinal plane; an iodinophile vacuole; type (and only) genus, *Myxobolus* Bütschli.

MYXOBOLUS Bütschli, 1882.

Bronn's Thier-Reich, I, t. 38, f. 6–10; *Myxosporidium*[§] Perugia, 1891, Boll. Scientif. Pavia, XIII, p. 23; *Myxobolus* et *Myxosporidium* Weltner, 1892, Sitzgsber. d. Gesellsch. Naturf. Freunde Berlin, pp. 34–35; *Myxobolus* et *Henneguya*[‖] Thélohan, 1892, Bull. Soc. philomat. Paris, IV, pp. 176, 177.

Definition: Characters those of the family; type *M. mülleri* Bütschli.

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[*] *Sporoplasm.* Protoplasm of the spore.

[†] I propose *Myxosporidium* Perugia (synonym for *Myxobolus* Bütschli) as the type genus of the Fam. *Myxosporidieæ* Perugia.

[‡] Except species which have suffered reduction of characters (*Myxobolus unicapsulatus* sp. nov., *M. piriformis* Thél.).

[§] I propose *M. merlucii* Per. as the type species of this genus.

[‖] I propose *H. psorospermica* Thél. as the generic type. No valid generic distinction seems possible between the untailed and the tailed forms, for which latter Thélohan proposed *Henneguya*. Apart from the absence or presence of a tail (both of which conditions may, according to good observers, occur in the same species; cf. Weltner. Sitzgsber. Ges. Naturf. Freunde Berlin, 1892, pp. 28–36) the only character relied upon for their separation is the constancy of 2 capsules in the tailed forms, but this is also the typical number for *Myxobolus* and the presence of two exceptional species does not militate against the rule.

Myxobolus unicapsulatus sp. nov.

(Psorosperm of *Labeo niloticus* Müller. Müller's Archiv., 1841, p. 487, t. 16, f. 5 *a–d.*)

Spore: Of the form and size of *Chloromyxum dujardini* Thél.; capsule only 1, obliquely directed.

Habitat: *Labeo niloticus*, from the Nile.

Myxobolus piriformis Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, p. 177.

Myxobolus inequalis sp. nov.

(Psorosperms of *Pimelodus blochii* (Valenc.) Müller, Müller's Archiv., 1841, p. 487, t. 16, f. 6 *a*, *b*.)

Spore: Length 11 μ; breadth, 7 μ; capsules 2 of *unequal* size.

Habitat: On *Pimelodus clarias* Bloch (=*Silurus clarias* Valenc.), from Guiana and Surinam.

Myxobolus mugilis Perugia, 1891.

Myxosporidium mugilis, Boll. Scientif. Pavia, XIII, pp. 23–4; ***Myxobolus mugilis*** Thélohan, 1892, Bull. Soc. philomat. Paris, IV, p. 166.

Myxobolus oviformis Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, p. 177.

Myxobolus mülleri Bütschli, 1882.

Bronn's Thier-Reich, I, t. 38, f. 6–10.

Myxobolus oblongus sp. nov.

(Psorosperms of *Catostomus tuberculatus* Müller, Müller's Archiv., 1841, pp. 487–90, t. 16, f. 7–9.)

Cyst: Round or elliptic, 1 mm. or less.

Spore: Spatular or round-oblong; length, 14 to 17 μ; greatest breadth and greatest thickness at about the junction of the anterior and second fourth of the length; breadth, 8.5 μ; thickness, 5 to 6 μ; width of ridge nearly equal to one-third of thickness; capsules, 2; nuclei 2, and perhaps[*] more; vacuole not seen.

Habitat: Subcutaneous on head of *Erimyzon sucetta* Lac. (= *Catostomus tuberculatus* Le Sueur).

Myxobolus ellipsoides Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, p. 177.

Myxobolus bicostatus sp. nov.

(Myxosporidian spore of branchiæ of *Tinca vulgaris* Bütschli, 1882; Bronn's Thier-Reich, I, t. 38, f. 19.)

Spore: Shell with 2 oblique ribs over the longitudinal axes of the capsules; capsular index 0.50.[†]

Habitat: Branchiæ of *Tinca tinca* L.

Myxobolus lintoni sp. nov.

(Psorosperms of *Cyprinodon variegatus* Linton, 1891, Bull. U S. Fish Com. for 1889, IX, pp. 99–102, t. 35, f. 1–16.)

Spore: Ovate; length, 13.9 μ; breadth, 11 μ; thickness about 8 μ; shell, valves separating rapidly in sulphuric acid (cold, concentrated); capsules, 2, equal; filaments extruded under influence of sulphuric acid and of iodine water; nuclei *ad plur.* 4, 2 of which are the pericornual;[‡] vacuole present.

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[*] The condition of the material being such as not to exclude the possibility of sporoplasmic degeneration, these results are not entirely decisive.

[†] *Capsular index.* The ratio of the length of the capsule to the antero-posterior diameter of the shell cavity.

[‡] *Pericornual nuclei.* The 2 nuclei ("granules" "globules") situated at the antero-lateral angles (*cornua*) of the sporoplasm or on the posterior extremities of the capsules.

Habitat: Subcutaneous, on *Cyprinodon* [illegible] from the [illegible] Holl, Mass., August 20, 1889.

Myxobolus obesus, sp. nov.

(Psorosperm of the "Ablette," Balbiani, [illegible]

Spore: Very broadly ovate.

Habitat: On *Alburnus alburnus* L.

Myxobolus cycloides, sp. nov.

(Psorosperms of *Cyprinus rutilus* [illegible] Müller [illegible] *d–g*.)

Spore: Subcircular-ovate to broadly rounded [illegible]

Habitat: Opercle and pseudobranchia of [illegible] May and June.

Myxobolus spheralis sp. nov.

(Psorosperms of *Coregonus fera* Claparède [illegible] Léman, Geneva, pp. 113 [illegible]

Spore: Untailed; perfectly spherical, [illegible] very strongly refringent "nucleus" [illegible]

Habitat: Cysts imbedded [illegible] *fera* Jur.

Myxobolus [illegible]

Cyst: [illegible]

Spore: [illegible] one-third [illegible]

Habitat: [illegible] Le [illegible] River. [illegible]

Myxobolus [illegible]

[illegible]

Myxobolus strongylurus, sp. nov.

(Psorosperms of *Synodontis schal*, Müller, Müller's Archiv., 1841. pp. 480–481, t. 16, f. 2.)

Spore: Body anteriorly blunter than in *M. schizurus;* length of body 9 μ; breadth 5.4 μ; tail single, undivided, very peculiar in being constantly oblique in the longitudinal plane.

Habitat: Encysted in skin of head of *S. schal* from the Nile.

Myxobolus kolesnikovi,* sp. nov.

(Psorosperms of *Coregonus fera* Kolesnikoff, 1886, Veter. Vestnik Kharkoff., v, pp. 242–248, f. 1–3.)

Cysts: Numerous (up to 80), spherical or oval, 10 to 30 mm. long by 7 to 20 mm. broad.

Spore: Round or oval with a sharp anterior end; tail single or double, thick at its origin, attenuating gradually.

Habitat: Interstitial connective tissue of the thoracic muscles of *Coregonus fera* Jur.

Kolesnikoff's figures show the "double" tail to be merely the separated (laterally shifted) halves of the really single tail. To this species should probably be approximated one of Claparède's 3 forms,† viz, the tailed form habitant in the muscles of *C. fera*.

Myxobolus linearis, sp. nov.

(Psorosperms of *Pimelodus sebæ* and of *Platystoma fasciatum* Müller, Müller's Archiv., 1841, p. 489, t. 16, f. 10).

Spore: Body lanceolate-linear; length 3 to 4 times breadth; capsules 2, equal, entirely parallel-appressed; tail single, occasionally double.

Habitat: Cysts in membrane lining branchial cavity of *Rhamdia sebæ* Cuv. & Val., and in branchial lamellæ of *Pseudoplatystoma fasciatum* L., both from South American rivers.

In cysts at the base of the dorsal fin of *Ameiurus melas* Raf., from Storm Lake, Iowa, a spore occurs which I strongly suspect to be identical with this species, as it answers in every respect to the above (rather meager) diagnosis. It is peculiarly interesting, as the tail is composed of a dorsal and a ventral half, and is insoluble in sulphuric acid (cf. *M. macrurus*).

Myxobolus schizurus, sp. nov.

(Psorosperms of *Esox lucius* Müller, Müller's Archiv., 1841, pp. 477–478, t. 16, f. 1.)

Cyst: 0.44 to 1.09 mm. in diameter.

Spore: Body oval, length 12 μ; breadth 6 μ; thickness one-half the breadth; tail stout at origin, 3 to 4 times length of body, very frequently (probably as a rule) more or less bifurcate; capsules 2, equal, diverging posteriorly.

Habitat: In cellular tissue of the eye muscles, in that of the sclerotic, and in that between the sclerotic and choroid of *Esox lucius* in May and June. Müller failed to find it in North American pikes.

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* Dedicated to N. F. Kolesnikoff, who first figured this form.

† Claparède in Lunel's Hist. Nat. d. Poissons du bassin du Léman, pp. 113.

Myxobolus creplini,* sp. nov.

(Psorosperms of *Acerina vulgaris* Creplin., 1842, Wiegm. Archiv. f. Naturgesch, I, pp. 61–63, t. 1, f. 1 *a-e*; *cf.* Weltner, 1892, Sitzungs.-Ber. Ges. Naturf. Freunde Berlin, pp. 29–31, 34).

Spore: Body elongate ventricose-elliptic; length 17.3 μ; breadth 5.8 μ; tail simple, as long as or a little longer than the body; capsules 2, equal.

Habitat: On *Gymnocephalus cernua* L., collected March 14, 1837.

Weltner believes the form observed by him in the ovary of *Esox lucius* to be identical with this form. Weltner's species was sometimes tailed and sometimes untailed.

Myxobolus psorospermica Thélohan, 1892.

Henneguya psorospermica, Bull. Soc. philomat. Paris, IV, pp. 167, 176.

Myxobolus diplurus, sp. nov.

(Psorosperms of kidney of *Lota vulgaris* Bütschli, 1882, Bronn's Thier-Reich, I, t. 38, f. 21.)

Description (from figure).

Spore: Capsules 2, equal, posteriorly situated; tail double from base, the 2 halves adnate.

Habitat: Kidney of *Lota lota* L.

CHLOROMYXIDÆ fam. nov.

("Chloromyxées" *et* "Myxidiées" (*pars*) Thélohan, 1892, Bull. Soc. philomat. Paris, IV, pp. 173, 176.)

Definition: *Phænocystes* destitute of antero-posterior, but possessing bilateral, symmetry;† capsules in 1 group at the anterior end; a bivalve shell, the plane of junction of whose valves is perpendicular (?) to the longitudinal; no vacuole; type genus *Chloromyxum* Ming.

CHLOROMYXUM Mingazzini, 1890.

Bull. Soc. Nat. Napoli, IV, p. 160; *ib.*, *Sphærospora, Myxosoma et Mixosoma*‡ Thélohan, 1892, Bull. Soc. philomat. Paris, IV, pp. 173, 175–6.

Definition: *Chloromyxidæ* with subspherical or ovate spores, whose breadth does not exceed their length; valves hemispherical; sporoplasm bilaterally and symmetrically situated; type *C. leydigii.*

CHLOROMYXUM *sens. strict.*

Definition: Quadricapsulate Chloromyxa; type *C. leydigii.*

Chloromyxum fluviatile Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, pp. 173, 176, fig. 2.

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* Dedicated to the discoverer, J. C. L. Creplin.

† Imperfect from unilateral position of sporoplasm in *Ceratomyxa.*

‡ See subgenus *Sphærospora*, p. 419. The table on p. 411 shows that *Sphærospora* and *Mixosoma* differ from *Chloromyxum* by only a single character, viz: the *number* of the capsules. As shown on p. 411, this character is a subordinate one compared to the *grouping* and *position* of the capsules, in which latter all the three genera agree. They may, therefore, all be grouped under one genus.

The two unispecific genera *Sphærospora* and *Mixosoma* have (at least as far as the record now shows) absolutely no distinctive character but the *shape of the spore.* They are therefore fused. Provisionally (but with some hesitation) I have recognized *Sphærospora* (including *Mixosoma*) as a subgenus. Its sole claim to such distinction rests on 2 capsules as against 4 in *Chloromyxum* proper. It is also worthy of note that the possibility of transitions are by this definition arbitrarily excluded, inasmuch as all our experience shows that increase of capsule number is by *duplication* and not by *addition.* So that the possibility of its ultimate entire fusion with *Chloromyxum* seems by no means remote.

Chloromyxum mucronatum sp. nov.

(Psorosperms of *Gadus lota* Lieberkühn, Müller's Archiv., 1854, pp. 352-3, 368, t. 14, f. 5, 6.)

Myxosporidium: Measuring 75 μ or less; spherical or ellipsoidal, rarely irregular.

Spore: Broadly rounded-oval; concave pointed anteriorly; length *ad max.*, 8 μ.

Habitat: Free in urinary bladder of *Lota lota* L.

Chloromyxum leydigii Mingaz., 1890.

Boll. Soc. Nat. Napoli., IV, pp. 160-4 (see also the next species).

Chloromyxum incisum sp. nov.

(Psorosperms of *Raja batis* Leydig, Müller's Archiv., 1851, pp. 225-226, 234, t. 8, f. 4*a-f*.)

Myxosporidium: Biliary yellow, roundish or somewhat elongate, 29 to 88 μ in diameter, without or with 1 to 4 pansporoblasts.

Spore: Sharply cuneate-oval, *posterior border radiate-incised*, resembling a radiate-ribbed Lamellibranch shell.

Habitat: Free in gall-bladder of *Raja batis* L.

In face of the striking difference between this spore-form and *C. leydigii*, the present evidence (which consists of Mingazzini's opinion[*] without any detailed evidence, Perugia's opinion,[†] too little explicit, and the probably not independent opinion of Thélohan [‡]) is insufficient to warrant the fusion of the two forms, especially as it does not appear that either Mingazzini or Perugia examined the gall-bladder of *Raja batis.*

Chloromyxum ? ? congri Perugia, 1891.

Myxosporidium congri, Boll. Scientif. Pavia, XIII, pp. 24-5, f. 15-20.

Habitat: Gall-bladder of *Leptocephalus conger* collected in August, 1890.

Subgenus SPHÆROSPORA Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, p. 175; *Mixosoma*[§] *et Myxosoma ibid.*, p. 175.

Definition: Bicapsulate Chloromyxa; type *Chloromyxum* (*S.*) *elegans* Thél.

Chloromyxum elegans Thélohan, 1892.

Sphærospora elegans, Bull. Soc. philomat. Paris, IV, pp. 167, 175.

Chloromyxum dujardini Thélohan, 1892.

(Psorosperms of *Cyprinus rutilus* (*pars*) Müller, Müller's Archiv., 1841, pp. 481, 486, t. 16, f. 4 *b*, *c*; psorosperm of *Cyprinus erythrophthalmus* Dujardin, 1845, Hist. Nat. des Helminthes, p. 644, t. 12, f. 12 N_1, 12 N_2.)

Mixosoma dujardini, Bull. Soc. philomat. Paris, IV, p. 175.

Myxosporidium: 1.25 to 1.50 mm. long.

Spore: Ovate, pointed anteriorly, broadly rounded posteriorly; length 10 to 12 μ; capsules 2, of equal size.

Habitat: Branchial lamellæ of *Leuciscus* (*Scardinius*) *erythrophthalmus* from the Vilaine, at Rennes, France; pseudobranchiæ of *Leuciscus rutilus*, from German rivers.

Concerning the form observed by him, Müller says:

> Once there was found on the pseudobranchiæ (*Nebenkiemen*) a mass of small yellow cysts. The size of this mass was 4 lines. This time all the cysts contained elongate capsules with pointed anterior and bluntly rounded posterior ends (f. 4 *b*). On the flat border the convex surfaces were exactly equal and the two diverging vesicles were attached interiorly at their points.

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[*] Boll. Soc. Nat. Napoli, 1890, IV, pp. 160-161.

[†] Boll. Scientif. Pavia, 1890, XII, p. 138.

[‡] Bull. Soc. philomat. Paris, 1892, IV, p. 176.

[§] Type *Chloromyrum* (*Mixosoma*) *dujardini*.

Thus this form was never found coexisting in the same cyst with *Myxobolus cycloides* sp. nov. Considering the great frequency of occurrence of the latter species such coexistence would be expected if they were merely different forms of one species. Their persistent non-association thus strongly reënforces the argument in favor of their specific distinctness, drawn from their different characters.

The synonymy is on the authority of Thélohan (letter to the author, 1893). He has found *Mixosoma dujardini* upon both of the fishes named above and believes that Müller's and Dujardin's figures represent the same species.

CERATOMYXA Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, pp. 169, 175.

Definition (provisional): *Chloromyxidæ* with bilaterally symmetrical, transversely extended, sub-isosceles-triangular spores, whose breadth greatly exceeds the length; valves hollow-conical with solid tips; sporoplasm unilaterally and asymmetrically situated; type *C. sphærulosa* Thél.

Ceratomyxa sphærulosa Thélohan, 1892.

Bull. Soc. philomat. Paris, IV, pp. 171–3, 175, fig. 1.

MYXIDIIDÆ fam. nov.

("Myxidiées" (*pars*) Thélohan, 1892, Bull. Soc. philomat. Paris, IV, pp. 173, 175.)

Definition (provisional, as regards negative characters): *Phænocystes* destitute of antero-posterior, but possessing bilateral symmetry; capsules in 2 groups in the (right and left) wings; no bivalve shell; no vacuole; type (and only) genus *Myxidium* Bütschli.

MYXIDIUM Bütschli, 1882.

Bronn's Thier-Reich, I, t. 38.

Definition: Characters those of the family; type *M. lieberkühnii* Bütschli.

Myxidium lieberkühnii Bütschli, 1882.

Bronn's Thier-Reich, I, t. 38, f. 12–15.

Probably a second species is Leydig's "psorosperm" of the bile-ducts of *Raja batis*, Müller's Archiv, 1851, pp. 226, 234, t. 8, f. 4*g*.

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